(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 149 448 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.02.2010 Bulletin 2010/05

(51) Int Cl.:
B29C 65/20 (2006.01) *B65B 13/32* (2006.01)

(21) Application number: 09166843.4

(22) Date of filing: 30.07.2009

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

(30) Priority: 30.07.2008 IT MI20081417
30.07.2008 IT MI20081418

(71) Applicant: OFFICINA MECCANICA SESTESE S.p.A.
28045 Paruzzaro (Novara) (IT)

(72) Inventors:
- Rossi, Gian Luigi
28046 Meina (Novara) (IT)
- Tacchini, Franco
28010 Nebbiuno (Novara) (IT)

(74) Representative: Faggioni, Carlo Maria et al
Fumero
Studio Consulenza Brevetti Snc
Pettenkoferstrasse 20-22
80336 Munich (DE)

(54) **Pile-strapping machine with straps made of weldable plastic material**

(57) A strapping system for a wrapping apparatus with a horizontal conveyor (T) is disclosed, of the type wherein a ring of plastic strap (R) is tightened around a travelling load to be wrapped (P), while the load moves along the conveyor. The strapping system comprises in particular a welding device for a plastic strap, wherein a heated blade (34, 106) is arranged for a substantially longitudinal relative movement with respect to the strap (R) and wherein at least one pressure element (103, 12a) is further provided, arranged so as to impart a pressure in a movable operating position with respect to the strap flaps and which acts downstream of the operating position of the movable heating blade (34, 106).

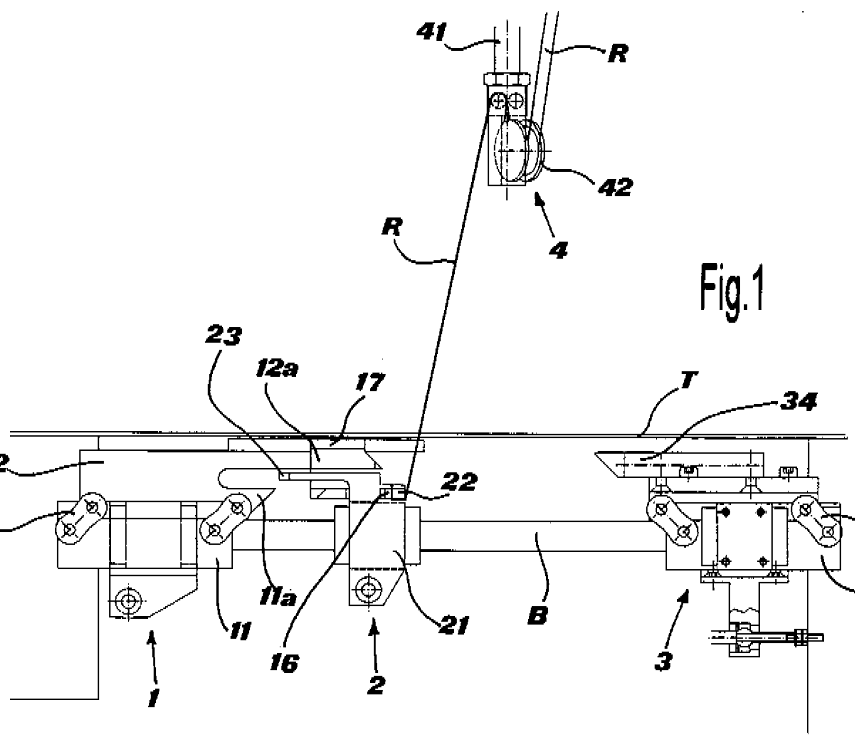


Fig.1

EP 2 149 448 A2

Description

Field of the Invention

[0001] The present invention concerns a strapping system to be used in wrapping machines, and more particularly it concerns a system for the driving, tightening and welding of a tape or strap, on a product to be wrapped.

Background of the Invention

[0002] Some examples of strapping machines are disclosed in patents IT-B-1,135,722 and EP-A-0,603,868, both in the name of the present Applicant, US-5,379,576 and US-A1-2005/0,028,485. All these known devices are based on the use of a system wherein the product to be wrapped - in the following called "load" in short, even though it can be for example a box, or a pile of thin products, or else - is brought into a fixed position of a strapping station, and here wrapped and tightened by a tape or "strap".

[0003] Such a strapping station essentially consists of a fixed bow, within which a strap is made to run to form a wrapper around the load, which is then tightened on the load and welded at the overlapping ends.

[0004] Strapping machines of this type, however, have a relatively low operating frequency, due to the load stopping time, which is necessary for accomplishing the strapping.

[0005] In order to overcome such drawback, so-called step strappers have also already been suggested. In this case, the strap wrapper extends on a plane longitudinally arranged to the load advancement direction and, rather, it is precisely the load which intercepts the strap and cooperates with the wrapping operation.

[0006] Some examples of these machines are disclosed in EP0178385A1, EP0401554A1 and WO9215486A1.

[0007] These machines can typically work with a higher productivity, even though they are less effective, per se, in the application of the tightening force. For these reasons, step strappers are well-suited for the wrapping of cardboard boxes. As a matter of fact, cardboard boxes are piled in a certain number in their folded status and naturally tend to expand elastically, increasing pile volume. This natural expansion causes tensioning of the wrapping strap even in case it was not perfectly stretched upon application thereof.

[0008] Conversely, the piles of cardboard boxes are by nature rather delicate (they are normally made of corrugated cardboard sandwiched between thin layers) and the strapping operation must hence be performed with a certain care and precision, albeit at high production rates.

[0009] Another problem arising both specifically in these machines and in general on strapping machines of any type concerns the strap-welding phase if the strap is made of a plastic material. As a matter of fact, the most effective welding process is obtained by heat supply by a welding blade. Traditionally, a heated blade is introduced transversally between the two strap edges to be welded; a pressing device is then applied which compresses the two edges against the heating blade, until they bring the surface material to a melting state; after that, the pressing device is brought back to home position, the heating blade is withdrawn and then the two edges of heated strap are pressed together again.

[0010] For a polypropylene strap this operation is performed effortlessly, at a heating blade temperature of about 280°C.

[0011] Viceversa, for polyester this operation causes drawbacks, because at the ideal melting temperature, of about 400°C, noxious gases would develop which are not allowed by current law. In order to overcome this problem, the welding is usually performed either with a blade at a temperature below 300°C, or using different methods (friction welding or vibration-welding).

[0012] However, these alternative solutions are not entirely satisfactory, because they are complex, costly and do not allow to obtain an effective welding, in particular of polyester. Recently, moreover, the need has arisen to use polyester straps of a significant width and thickness (for example 32x1.5 mm) because, due to the mechanical properties of this material, it would be possible to obtain a strap of a quality comparable to a metal strap, without the typical drawbacks of said strap.

[0013] The limitations to the working temperature of the heating blade, as well as the fact that the adhesion area is rather small, do not produce an excellent welding of two plastic strap edges and hence, in particular, they do not allow to suitably exploit the mechanical properties of polyester.

[0014] The present invention hence aims at solving the problem of performing, in a particularly effective and controlled way, the step strapping of piles of folded cardboard boxes (or similar loads) while they advance along a conveyor. Moreover, it aims at improving the welding system of the strap edges, if they are made of plastic material, in any strapping machine and, in particular, in a step strapping machine.

[0015] Such objects are achieved through the features highlighted in the enclosed independent claims.

[0016] Other inventive aspects of the machine are disclosed in the dependent claims.

Brief Description of the Drawings

[0017] Further features and advantages of the invention are in any case more evident from the following detailed description of preferred embodiments, given purely by way of a non-limiting example, and shown in the enclosed drawings, wherein:

figs. 1 and 1a show the general diagram of a strapping machine according to the invention, in an elevation view and in a top plan view, respectively, in a phase immediately before the strapping operation;

figs. 2 and 2a are views fully similar to those of figs. 1 and 1a, in an initial work step of the strapping operation;

figs. 3 to 13 and 3a to 13a are views fully similar to those of figs. 1 and 1a, which show a sequence of further work steps up to completion of the strapping operation;

fig. 14 is a partial top plan view, of the control members according to the invention;

fig. 14a is a top plan view of the translation plane in correspondence of the strapping station;

fig. 15 is a side elevation view of part of the control members shown in fig. 14;

fig. 15a is a part-section, front elevation view, of the upper part of fig. 15;

fig. 16 is a diagrammatic, side elevation view of a generalisation of the welding system for straps according to the invention, in a first operation step; and

figs. 17-21 are views similar to those of fig. 16 in subsequent operation steps.

Detailed Description of some Preferred Embodiments

[0018] As diagrammatically shown in the drawings, the strapping system according to the present invention is applied along the path of a load conveyor (comprising for example also a series of motor-driven cylinders) of which, in the drawings, only a sliding plate T is shown. This system essentially comprises three units, arranged below the plane of conveyor T and called main assembly 1, abutment assembly 2 and locking and welding assembly 3. As a completion of the strapping system according to the invention, a strap supply assembly 4 is provided which, as will be shown in the following, is vertically mobile, from a home position above the plane of conveyor T to a work position below the same.

[0019] All these assemblies are always shown, in the drawings from 1 to 13, in diagrammatic elevation views and, in the drawings from 1a to 13a, in diagrammatic top plan views.

[0020] Main assembly 1 consists of a castle framework 11, whereon a pressure countercursor 12 is firstly mounted, by means of a pair of arms 13 forming an articulated parallelogramm, which allows a slight, springy vertical/horizontal translation movement thereof in opposition to elastic means (not shown). Castle framework 11 is slidingly mounted on rail B and has a spur 11a, arranged at a lower level with respect to appendix 12, provided with a wedge-shaped edge, the usefulness whereof will be obvious further on.

[0021] In a fixed position there is furthermore mounted an arm 14, rotatable about a vertical-axis, fixed hub 15. Countercursor 12 extends backwards (with reference to the direction of advancement of a load, indicated by arrow F in fig. 2) with an elongated appendix 12a, ending with a bevelled wedge-shaped edge.

[0022] An abutment bracket equipped above with an abutment plate 17 and below with a stop notch 16 is also provided in a fixed position. Stop notch 16 belongs to a small plate which ends at the front with a bevelled wedge-shaped edge 17a.

[0023] With abutment bracket 17 there is associated a small unit, rotatable about a vertical axis 18b, which carries a knife 18 and a gripping arm 18a provided with a notch-shaped appendix 18c.

[0024] Abutment assembly 2 is instead mounted on a saddle 21, slidably mounted on a rail B. Saddle 21 carries, on one side, in a lower position (i.e. at a height suitable for cooperating with notch 16) and more backwards with respect to direction F, a pressure roller arm 22 and, in a higher position (i.e. just below countercursor 12) and more forward, a thrust arm 23.

[0025] Locking and welding assembly 3 also consists of a saddle 31, slidably mounted on rail B, carrying a heated wedge-shaped element 34 mounted oscillating by means of a pair of arms 33 forming an articulated parallelogramm (in a way equivalent to countercursors 12 on assembly 11). This welding member, as it will be better highlighted also further on, has a shape and a way of operation disclosed in more general terms further on in the specification.

[0026] Strap supply assembly 4 essentially consists of a vertically slidable post 41, which carries a transmission pulley 42 of strap R coming from a supply bobbin (not shown). The drawing does not even show the vertical moving system of post 41, since it is an arrangement fully within the reach of a person skilled in the field and which in any case is not part, per se, of the present invention.

[0027] The movement of the various working members, just briefly described, is guaranteed by a group of rotary cams, each connected with its respective working members through control rods, which are driven into rotation by a motor assembly and by the corresponding clutch (fig. 14).

[0028] Greater details on the system structure and on its mode of operation are in any case better understandable following the various operation steps thereof through the illustration of drawings 1 to 13.

[0029] As already mentioned, figure 1 shows the strapping system in a home position, waiting for a load P (for example a pile of folded up cardboard boxes) arrives along conveyor plane T to be wrapped by wrapping strap R. The initial end of strap R is, in this position, tightened between stopping notch 16 and pressure roller arm 22 of saddle 21.

[0030] Figures 2 and 2a show a load P which, moving along conveyor plane T in the direction of arrow F, meets strap R and drags it to the position shown, while it begins to wrap load P. Although it is not shown, it is preferable for the load to be pushed onto plane T by a pusher device: this ensures that the load has overcome the positions established during strapping and, at the same time, makes very quick movements (as a matter of fact, the entire strapping cycle, must occur in an extremely short time, of the order of the second).

[0031] In this step, assemblies 1, 2 and 3 are still in the position of figs. 1, 1a; one can see, however, that strap R, in addition to extending across load P, bends forward, enters slit T_1 of plate T and also adheres to assembly 1, and in particular to abutting plate 17.

[0032] Fig. 3 shows, on one side, that load P has advanced further and, on the other side, that arm 14 has performed a rotation (clockwise with respect to fig. 3a) so as to bring the notch 14a thereof in contact with abutting plate 17, thereby tightening between the two another portion of strap R. Thereby, strap R is tightened and blocked also in a higher position than the initial tightening position (i.e. between 16 and 22).

[0033] Figures 4 and 4a show that load P has advanced further and at the same time saddle 2 has moved backwards, in the direction of arrow F', so as to release the lower end of strap R, following the mutual moving away of stopping notch 16 and pressure roller arm 22. The strap end is now retained only between notch 14a and abutment 17.

[0034] Figures 5 and 5a show that load P has advanced further, until it has overcome the vertical alignment with assembly 4 and released the window T2 of plate T.

[0035] In this step the supply assembly of strap 4 can be made to descend as low as below the plane of conveyor T. As can be noticed, the wrapping of load P with strap R is now nearly complete.

[0036] In this step, the unwinding of strap R is preferably suitably clutch-operated, so as to impart a tension suitable for compressing the load: the pile of folded up cardboard boxes hence compresses elastically.

[0037] It can be noticed (fig. 5A) that the driving rod 41 of assembly 4 is laterally displaced with respect to the strapping line: this allows system effectiveness (in particular the arrangement of strap R opposite pressure roller arm 22) without interferences occurring between the various driving members.

[0038] Figures 6 and 6a show that - the other parts remaining stationary - saddle 2 has again moved forward (arrow F) to perform two actions: on one side, the thrusting action of arm 23, which pushes the free end of strap R above stopping notch 16 and below appendix 12a and, on the other side, the gripping action by pressure roller arm 22, which grips strap R in a position below the plane of conveyor T and downstream of assembly 4 and begins to drag it towards stopping notch 16.

[0039] Figures 7 and 7a show the completion of the function of saddle 2 which, coming even further forward (arrow F) has led strap R to wrap load P nearly entirely. As already shown, the two strap portions are now fastened, on one side, between abutment plate 17 and notch 14a and, on the other side, between stopping notch 16 and pressure roller arm 22.

[0040] Figures 8 and 8a show a further step of the strapping process according to the invention, consisting in the cutting of the strap portion R which is still connected to the vertical translation assembly 4. Arm 18a has been rotated counterclockwise (according to fig. 8a) about pin 18b, to bring knife 18 to cut the strap and bring the notch-shaped appendix thereof 18c to grip the strap edge which is released by the cut and to tighten it against the rear side (with respect to direction F) of notch 14a. As clearly shown in fig. 8, it should be noticed that notch 18c is arranged above the operation plane of blade 18, which cuts strap R in the proximity of the gripping point between arm 22 and notch 16. Thereby, once cut, strap R ends, also in the rear part thereof, with a free edge below the gripping point between notch 18c and notch 14a, as visible in fig. 9.

[0041] It is also important to notice that, taking into account the fact that, before the cut, strap R is stretched between the load and the gripping point with pressure roller arm 22 (fig. 7), this further action by notch 18c - provided the two gripping points along the winding plane of the strap are suitably scalar - translates into a further stretching of strap R, which contributes to the tightening of the load wrap.

[0042] Figures 9 and 9a show that the operation of cutting strap R has been performed, knife 18 being in an end-stop position (fig. 9a), while notch 18c keeps the tightening thereof against notch 14a. From fig. 9 it is evident also an initial step of forward movement of assembly 3, to bring wedge-shaped cursor 34 closer to the free rear edge of the strap.

[0043] From figures 10 and 10a, in particular from fig. 10, it is evident that cursor 34 has pushed said free edge of strap below notch 14a.

[0044] Since cursor 34 is suitably heated (although a temperature of about 80°C is sufficient to cause the melting of the plastic material, it is preferable to overheat the cursor to about 280-300°C to ensure the necessary heat supply even at the high operation speeds required by the apparatus), each portion of plastic strap which comes in contact therewith is softened accordingly up to a weldable condition.

[0045] According to a preferred embodiment, it hence embeds electric heating resistances, apt to increase the temperature thereof, at least at the time when the strap welding must be performed, to a melting temperature of the plastic material making up the strap being used.

[0046] Advantageously, the head end of cursor 34 is wedge-shaped, with an opposite and complementary inclination to the one of end 12a whereon the front edge of the strap lies.

[0047] Therefore, during the mutual coming closer of cursor 34 to end 12a, the thrust force in a horizontal direction on the head of cursor 34 turns also into a pressure directed towards the top of cursor 34 on the above-lying strap in contact with notch 14a.

[0048] The elastic suspension mounting of cursor 34 and of countercursor 12 cooperates to allow also a vertical pressure.

[0049] This joint effect of pressure and heating acts in an optimal way to soften the surface layer of the rear edge of the strap, for the purpose of a subsequent welding thereof to the front edge.

[0050] After cursor 34 has reached the position of fig. 10, assembly 1 and assembly 2 are jointly displaced backwards (arrow F'), keeping instead fixed notch 14, 14a.

[0051] Due to this joint displacement, cursor 34 is pushed backwards and taken off from below notch 14a, while it continues to supply heat and pressure to the above-lying edge of the strap, which is progressively left free. In the meantime, appendix 12a of the counter-cursor slides below the same notch 14a bringing the free front edge of strap R against and below the rear edge. Since also the plate of countercursor 12 has a wedge-shaped head 12a, in this operation step also appendix 12a is led to push upwards the initial end of the strap against said end-piece, hence welding the two strap ends one on top of the other.

[0052] The upward thrust is obtained especially by the engagement of bevelled edge 16a with bevelled spur 11a, which translate the horizontal translation movement of assembly 1 into a vertical pressure.

[0053] Figures 12 and 12a show a step wherein saddle 3 with corresponding cursor 34 is brought backwards again (arrow F') into its initial home position, leaving free the space for the upward return of assembly 4.

[0054] In this step, the strap edge coming from the storage is kept gripped by notch 22, hence integral with assembly 2, ready for the beginning of a new strap winding cycle.

[0055] Figures 13 and 13a show a further step, wherein assembly 4 is by now well above the plane of conveyor T and of the top of load P; at the same time arm 18a has returned backwards (clockwise rotation in fig. 13a), into the position in which notch 18c moves away from notch 14a, so as to release the strap wrap in this position.

[0056] In a final step (equivalent to fig. 1a) arm 14 is also caused to rotate in a counterclockwise direction, to remove notch 14c from the by now welded wrapper of strap R, so as to release load P and allow the continuation of the travel thereof along conveyor T.

[0057] Despite the removal of notch 14a, strap R does not remain loose, because the slack is promptly taken up by the elastic return of the pile of cardboard boxes P, which always guarantees a good stretching of strap R on the load.

[0058] Figures 14 and 15 show, in top plan and side elevation views, respectively, a diagram of the motorisation and motion transmission to the driving members of the strapping system, and precisely to assemblies 1, 2, 3 and 4 described above. A motor 5 actuates, through a motion transmission comprising also a reducer 6, a shaft 7, whereon multiple cams 8 are keyed on. Each of these cams in turn acts, through a follower lever 9, on a tie-rod 10; of course there are provided as many cams as the tie-rods are, i.e. the operating assemblies actuated by these tie-rods. Fig. 15 shows diagrammatically a tie-rod 10b for controlling the movements of abutment assembly 2 and a tie-rod 10c for controlling the movements of welding assembly 3, while the control tie-rod of main assembly 1 is not visible. In fig. 14 there are instead schematised tie-rod 10d for controlling the oscillation of arm 14 with notch 14a, and tie-rod 10e for controlling the oscillation of arm 18a with knife 18 and notch 18c.

[0059] The individual assemblies, according to the specific movement they are intended to perform, are rotatably mounted on suitable bearings/brass or slidingly on linear guiding rods/rails.

[0060] This motorisation has the advantage of great construction simplicity and at the same time of a great operation simplicity, since it is possible - through the design of the cam profile and of the keying angle thereof on shaft 7 - to obtain a perfect synchronisation, stable over time, of the different driven assemblies.

[0061] Reduction assembly 6 preferably comprises also a clutch to be able to determine at least two steps of variable slackness of shaft 7. In particular, it is necessary to determine a more or less pronounced slackness between one load and the other (depending on the distance between loads) and between the beginning and the end of the strapping step of each load (depending on the length thereof). The operation steps of the clutch can be determined by the signal issued by a photocell detecting the passage of the front and rear sides of each load as it progresses on conveyor T.

[0062] In figs. 16-21 another embodiment is shown of the strap welding system according to the invention, with reference to a generalisation of a strapping machine, not necessarily of the step type.

[0063] Strap tape R, coming from a bobbin (not shown), can be wound around load P in the way shown above, or in any known way. For example, as shown, strap R comes from the lower part of the load and is made to run through a first gripping element 101 before running around load C. The end edge of the strap is then again guided horizontally, made to run through a second gripping member 102 and then halted against the remaining strap portion, in correspondence of point A.

[0064] According to a first embodiment, the welding device provides that in the proximity of halting point A there is arranged a mobile pressure roller 103, which has the double function of accompanying the strap inside first gripping member 101, as well as pushing the strap during the welding work step. For such purpose, pressure roller 103 is preferably rotatably mounted on a displacement body 103a, which is in turn slidably mounted on a rail 104 and actuated by a linear actuator 105. Moreover, displacement body 103a, or the same pressure roller 103, is mounted elastically pushed towards the load resting plane - i.e. it is pushed upwards, in the representation of the drawings - so as to be able to impart a significant elastic thrust against the strap during the welding step.

[0065] Rail 104 is aligned with the sliding plane of the strap, i.e. the plane whereon the strap wrapper is formed. Therefore, the displacements guided by rail 104 are parallel to the development plane of the strap tape.

[0066] Preferably, displacement body 103a also has a sliding channel for strap R, which is substantially orthogonal to the displacement direction of body 103a. The entrance 103a' of this strap sliding channel, in the strap-launching work position, ends in register with an equivalent sliding channel of a fixed lower guide G. The cooperating surfaces of guide G and of displacement body 103a are shaped as a cutting edge, so that a mutual displacement of these two members leads to cut off strap R.

[0067] Moreover, according to this embodiment, on the side opposite to first gripping member 101, with respect to contact point A, a preferably wedge-shaped heating blade 106 is provided, also slidingly mounted on rail 104.

[0068] According to a preferred embodiment, wedge-shaped blade 106 can translate on rail 104 through the action of an actuator 107 which acts on a blade-carrying slide 106a. Blade 106, as already mentioned above, is floatingly mounted on blade-carrying slide 106a, i.e. partly free to oscillate elastically in an orthogonal direction to rail 104. For example, blade 106 - as diagrammatically shown in fig. 16 - is articulated with a parallelogramm system articulated to blade-carrying slide 106a, with the arrangement of elastic dampening members.

[0069] The front portion of wedge-shaped blade 106 is maintained at the desired welding temperature (for example between 280 and 300°C) and is intended to wedge in between the front flap of the strap (i.e. the free flap) and the tail portion of the strap lying on cylinder 103, in the proximity of the contact point with the front flap.

[0070] Please notice that heating blade 106, due to the mounting on rail 104, is itself apt to perform a displacement substantially aligned with the lying plane of the strap wrapper, i.e. parallel to the longitudinal axis of the front flap of the strap.

[0071] The operation of this exemplifying device is shown in the following.

[0072] A plastic strap R, removed from a respective bobbin, is introduced or launched in the direction of arrow V along the sliding channel found in fixed body G and in displacement body 103a. The front flap of strap R follows the wrapper around load P, running on cylinder 103 and through the two gripping members 101 and 102, until it ends in A in contact with the tail portion of the strap.

[0073] At this point (fig. 17), the second gripping member 102 is raised to retain strap R.

[0074] The strap is then retrieved and tensioned, pulling the tail portion (fig. 18), until tightening the strap wrapper around load P with the desired tension.

[0075] In the next step, also the first gripping member 101 is raised and blocks the strap immediately downstream of pressure roller 103 (fig. 19).

[0076] Then, displacement body 103a is made to progress (fig. 20) by actuator 105, until it cuts the strap in correspondence of the sliding plane between entrance 103a' and fixed body G. The pressure roller simultaneously progresses, distancing itself from first gripper 101 and moving the tail of strap R closer to heating blade 106.

[0077] Simultaneously, also actuator 107 can cause heating blade 106 to progress towards pressure roller 103, bringing blade 106 from the home position shown in fig. 16 to the work position of fig. 20.

[0078] In its feed movement, pressure roller 103 not only brings the tail strap in contact with the heating blade, but pushes said blade in the same direction. In actual fact, thanks to the specific mounting arrangement of blade 106 on slide 106a, cooperation with pressure roller 103 also leads to a lifting of blade 106, which hence comes in contact also with the overlying front portion of the strap.

[0079] The contact of the heating blade with the two strap portions causes the local softening or melting of the two opposite surfaces of the two front and tail flaps of strap R.

[0080] As the pressure roller advances, the heating blade progressively moves backwards along the same longitudinal axis of the strap tape, softening a long portion - which can be defined as desired - of the two strap flaps. During the advancing of the support body 103a, it is achieved that pressure roller 103, simultaneously, immediately compresses the two strap flaps with one another, softened by the previous passing of heating blade 106. The softening action is hence continuous along the longitudinal development of the strap and the pressure action immediately follows the heating action, without time for any local cooling.

[0081] In substance a "step" or "friction" heating of the connecting surface of two strap flaps occurs, with immediate pressure which completes an effective welding. The pressure between the two strap flaps is particularly effective as pressure roller 103 acts against a fixed abutment plate 108 below the load P to be wrapped.

[0082] The advancing of body 103a can end when a sufficiently long portion of the two strap flaps has been welded. If one intends to cause the entire tail to adhere to the front flap, it is necessary for the advancing travel to be at least equal to the development of the strap path existing between point of contact A and the entrance of cutting edge 103a'.

[0083] At the end of the welding (fig. 21), all the members return to the start position (of fig. 16), in correspondence of which it is possible to perform a new strap launch.

[0084] By means of this configuration, a welding device and relative welding method is provided which is extremely efficient, because it allows to join two flaps of plastic strap along a significant length, which can be defined according to requirements. Therefore, even in case of use of polyester, it is possible to operate at temperatures of about 300°C - without producing noxious vapours - because the smaller adhesion of the joining surfaces is offset by the wide welding surface, so as to ensure in any case high mechanical resistance.

[0085] However, it is understood that the invention must not be considered limited to the particular embodiments illustrated above, which represent only non-limiting examples of the scope of the invention, but that a number of variants are possible, all within the scope of a person skilled in the field, without departing from the scope of the invention, as defined by the attached claims.

[0086] For example, although it is not shown, in the specific case of the strapping of piles of open boxes, it can be provided to install also a pressure device which compresses the pile of load P to the desired size before ending the strap closing procedure.

Claims

1. Strapping apparatus for a wrapping machine with a horizontal conveyor (T), of the type wherein a plastic strap ring (R) is tightened around a travelling load to be wrapped (P), while the load moves along the conveyor, comprising
means (4) for transfering a strap portion above or below the plane of conveyor (T),
first means for gripping and retaining (16, 22) an initial flap of said strap at a predetermined distance below the plane of conveyor (T),
transport means for advancing the load on the conveyor and intercepting and dragging the strap portion (R) running between said initial flap and a strap feeding storage, for wrapping the load,
second means for gripping and cutting (18, 18a, 18c) a strap portion below said transport plane (T) so as to form a final strap flap, **characterised in that** it further comprises
welding means (3, 34) apt to come in contact in sequence with said initial and final strap flaps leading them to a softened state suitable for mutual welding, and
countercursor means (12, 12a) apt to cause said initial and final strap flaps to adhere to each other for completing the mutual welding thereof.

2. Strapping machine as claimed in claim 1), wherein said welding means (3, 34) comprise a heated cursor (34) provided with a wedge head apt to cooperate with a wedge appendix (12a) of said countercursor (12).

3. Machine as claimed in claim 2), wherein said heated cursor (34) and said countercursor (12, 12a) are movable along a same axis substantially lying on the plane of the strapping ring and in a position lying below the plane of transport (T) and wherein said heated cursor (34) is movable in a direction resting on one of said initial or final strap flaps, in a movement direction opposite to said countercursor (12), pushing the latter one of said initial or final strap flaps against the former one to achieve the mutual welding of the two flaps.

4. Machine as claimed in claim 2) or 3), wherein said heated cursor (34) and said countercursor (12) are mounted elastically oscillating in a vertical direction on a horizontal translation rail (B).

5. Machine as claimed in claim 4), wherein said countercursor (12) is integral with a translation support (11) provided with a wedge-shaped spur (11a) apt to engage, during a translation movement, with a corresponding wedge-shaped edge (6a) of a fixed bracket mounted below the plane of transport (T).

6. Machine as claimed in any one of the preceding claims, wherein second upper gripping means (14, 14a, 17) are further provided, apt to grip a strap portion in the proximity of said initial flap, immediately below the plane of transport (T), said upper gripping means being fixed along the plane of transport (T) and comprising an abutting plate (17) and a cooperating gripping tooth (14a) of an arm (14) rotating about a fixed axis (15) orthogonal to the plane of transport (T).

7. Machine as claimed in any one of the preceding claims, wherein at least the movement of said cursor and countercursor is guaranteed by corresponding control rods which are controlled by actuating cams (8) mounted on a same rotating shaft (7) driven into rotation by a motor (5) and a relative transmission assembly (6) provided with a clutch.

8. Welding device for a plastic strap in a strapping machine, of the type comprising a guiding path of a strapping tape having two flaps to be joined and a heated blade mounted movable with respect to said strapping tapes, **characterised in that** said heated blade (106, 34) is arranged for a substantial longitudinal relative movement with respect to said strap tape (R) and **in that** it further comprises at least one pressure element (103, 12a) arranged so as to impart a pressure in a movable operating position with respect to said tape flaps of the strap (R) and which acts downstream of the movable operating position of the heating blade (106, 34).

9. Welding device as claimed in claim 8), wherein said heating blade (106, 34) and said pressure element (103, 12a) are mounted below a support plane of a load to be wrapped (P) of the strapping machine and are mounted movable along an axis lying in the development plane of a strap ring (L).

10. Welding device as claimed in claim 8) or 9), wherein said heating blade (106, 34) is arranged between a first flap and a second flap of said strap, the former of said flaps being maintained fixed in contact with an abutting plane and the latter of said flaps resting on said pressure element (103, 12a) and being progressively brought in contact with the first flap by the progressive shift of said pressure element.

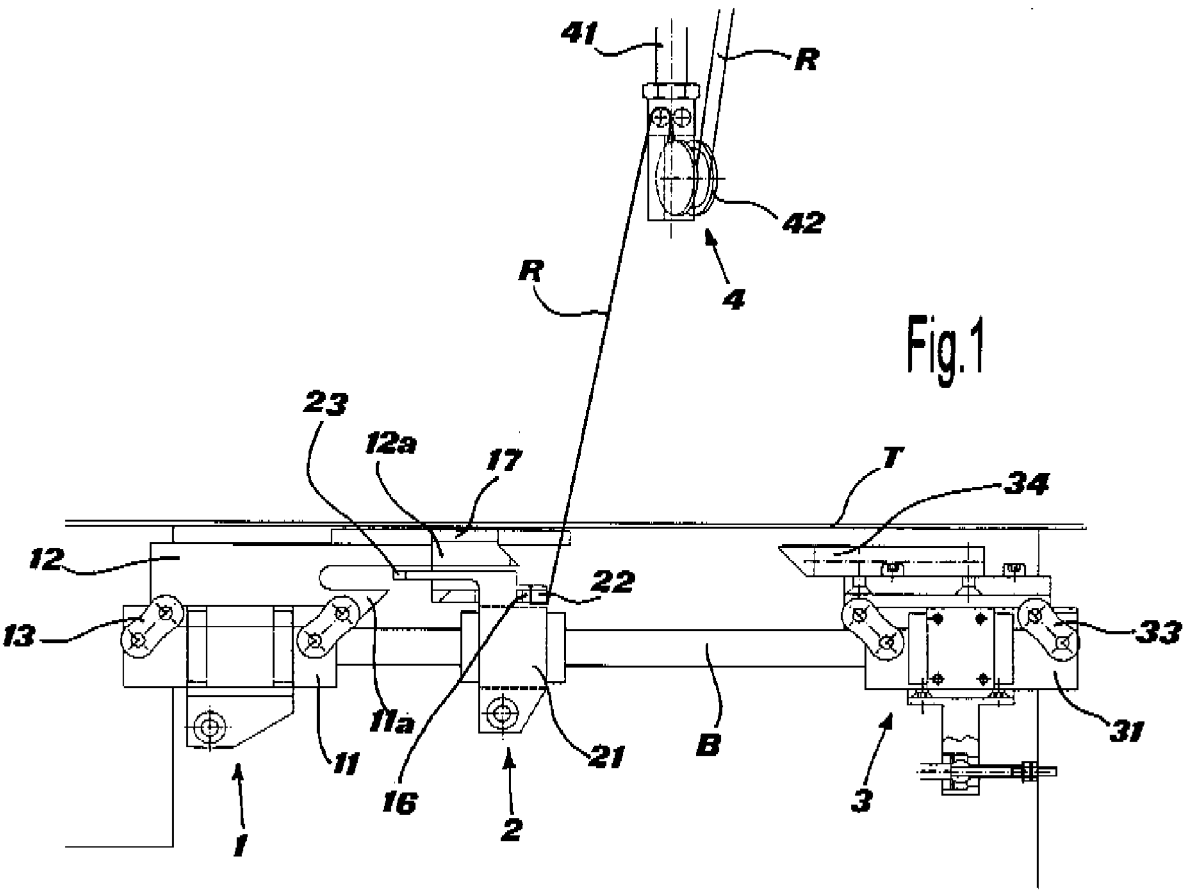
11. Welding device as claimed in claim 10), wherein said heating blade (34, 106) is slidingly and floatingly mounted on a slide body (106a, 31, 33).

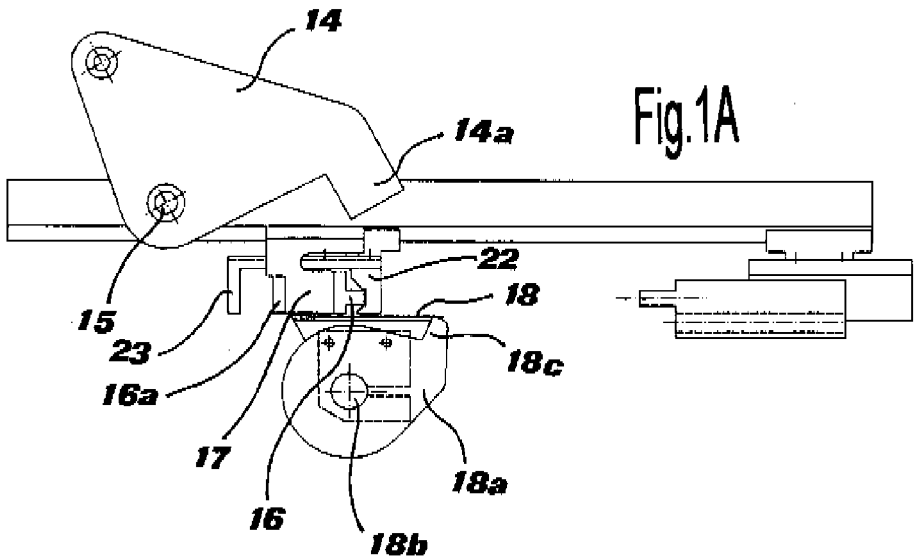
12. Device as claimed in any one of claims 8) to 11), wherein said heating blade (106, 34) is wedge-shaped.

13. Device as claimed in any one of claims 8) to 12), wherein said pressure element is a rotary pressure roller (106).

14. Strapping machine as claimed in any one of claims 1) to 7), **characterised in that** it comprises a welding device as claimed in any one of claims 8) to 13).

15. Method for welding two portions of plastic strap, of the type comprising the steps of bringing a heating blade (106, 34) in contact with connecting surfaces of the two strap portions and subsequently imparting a joining pressure on said contact surfaces, **characterised in that** it comprises the steps of
bringing said heating blade (106, 34) closer to both said contact surfaces, establishing a relative movement between the blade and the straps in a longitudinal direction to the strap tape and
applying a pressure between said two strap portions through a pressure element (103, 12a) in a point downstream of said heating blade (34, 106) and progressively translatable with respect to said straps in a longitudinal direction to the strap tape.


41
R
42
4
R
Fig.1
23
12a
17
T
34
12
22
13
33
11a
B
31
11
21
16
2
3
1


14
Fig.1A
14a
22
18
15
23
18c
16a
17
18a
16
18b

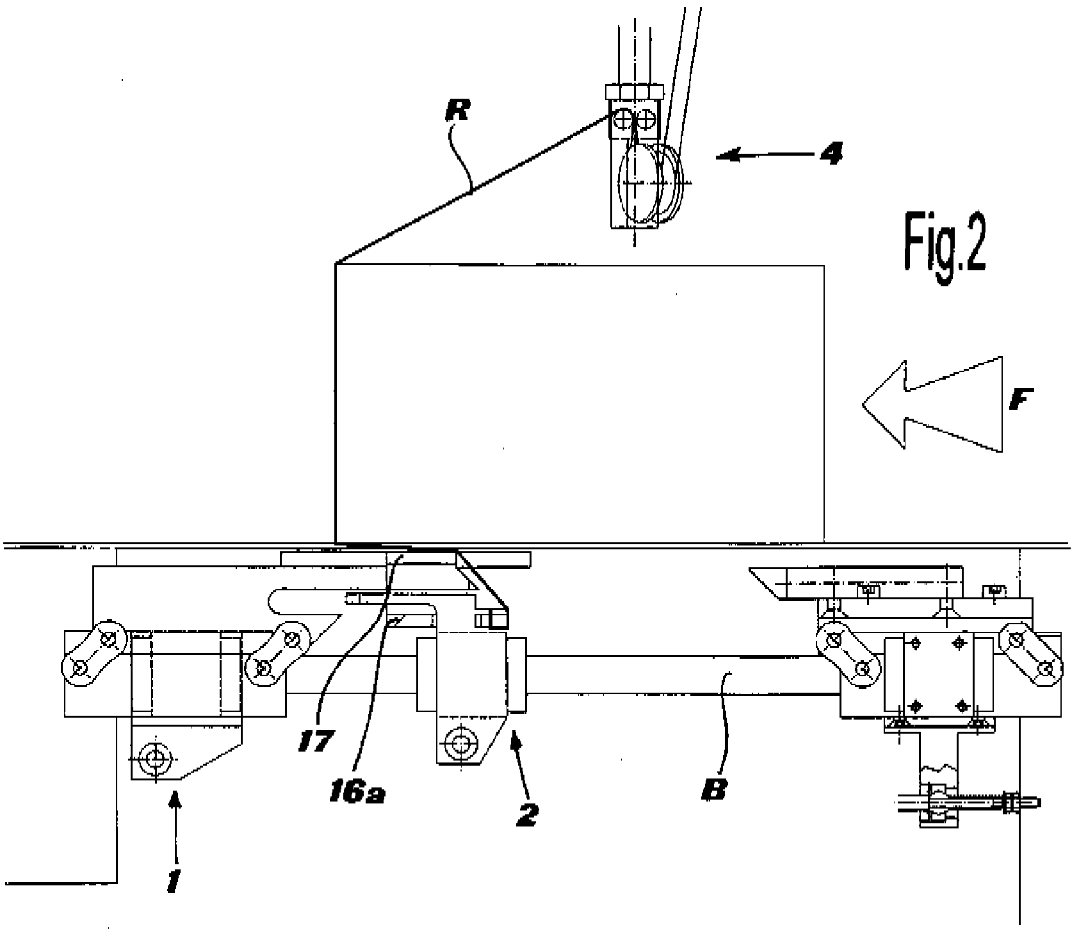


Fig.2

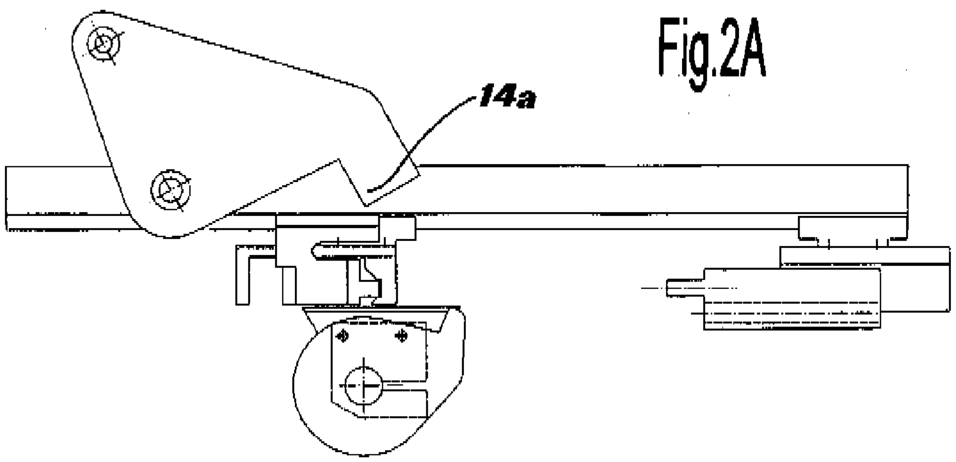


Fig.2A

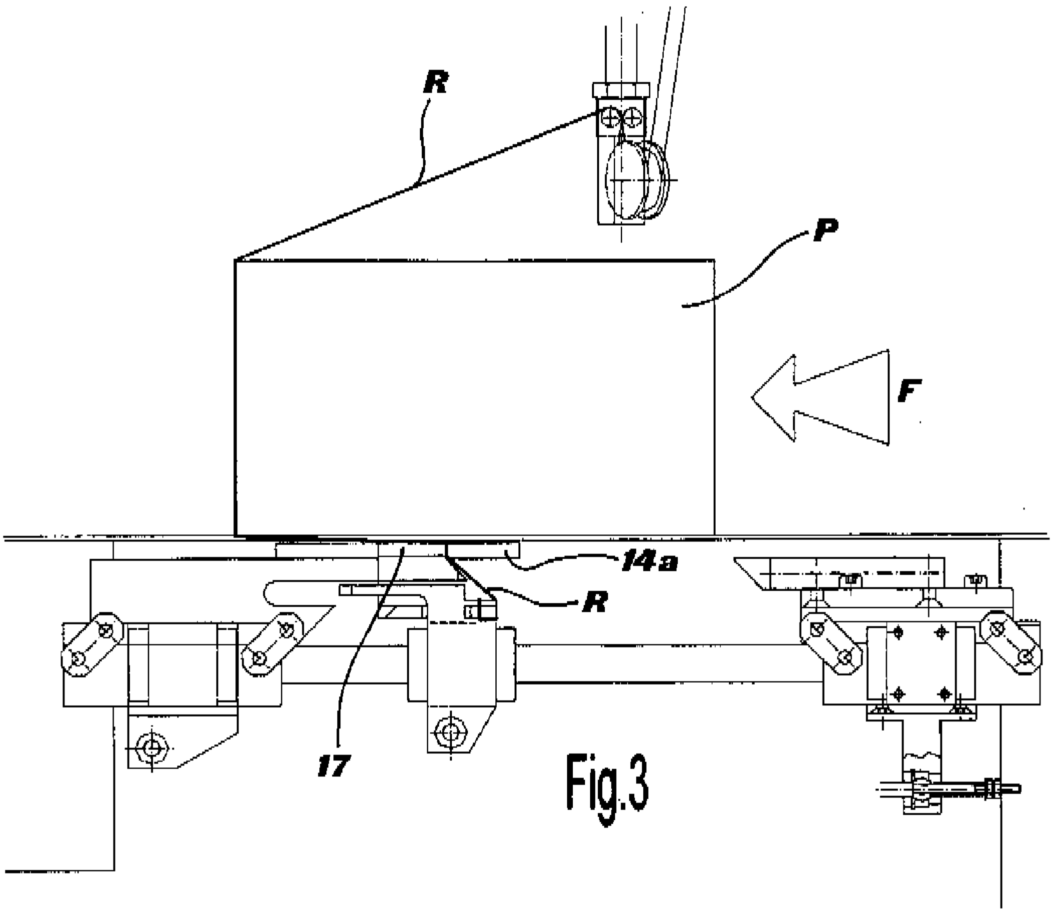


Fig.3

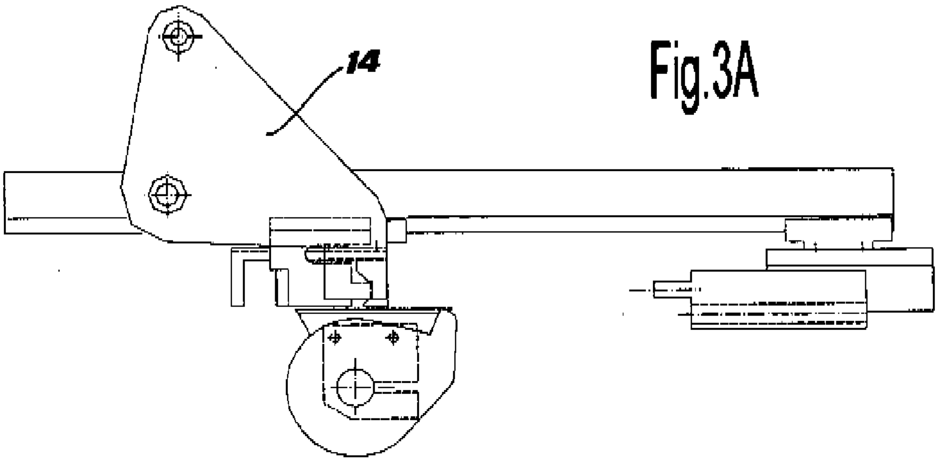


Fig.3A

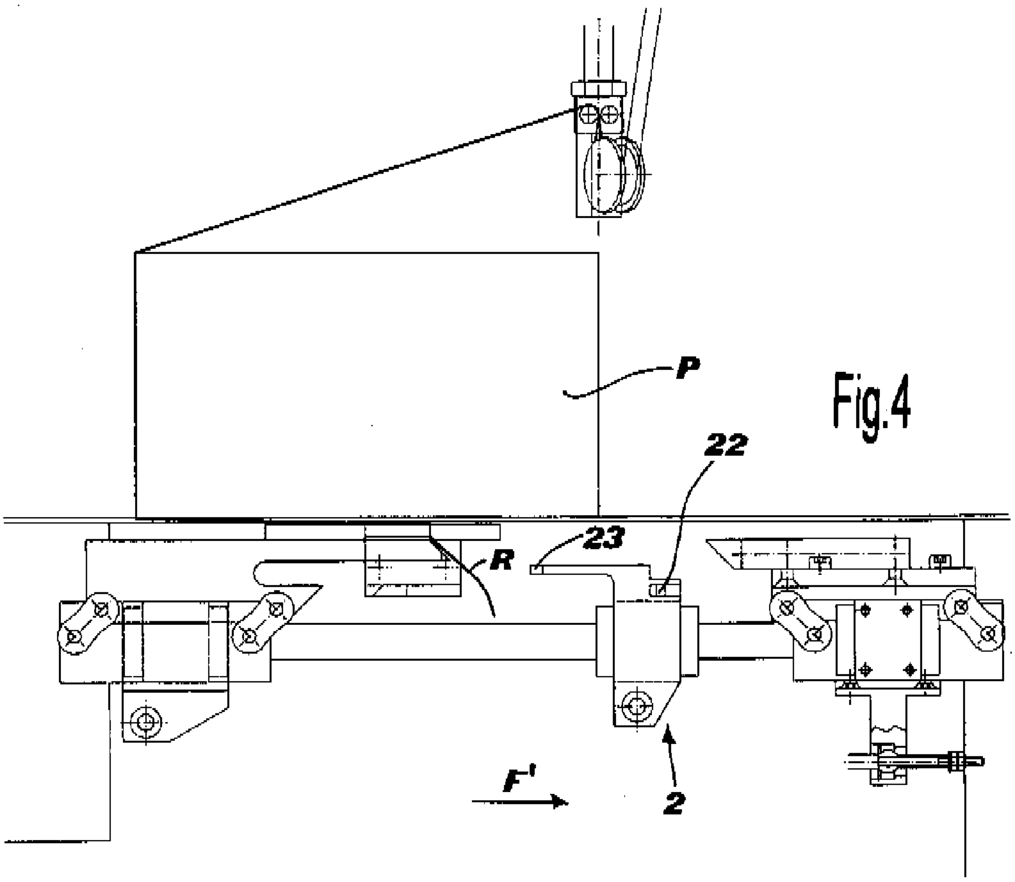


Fig.4

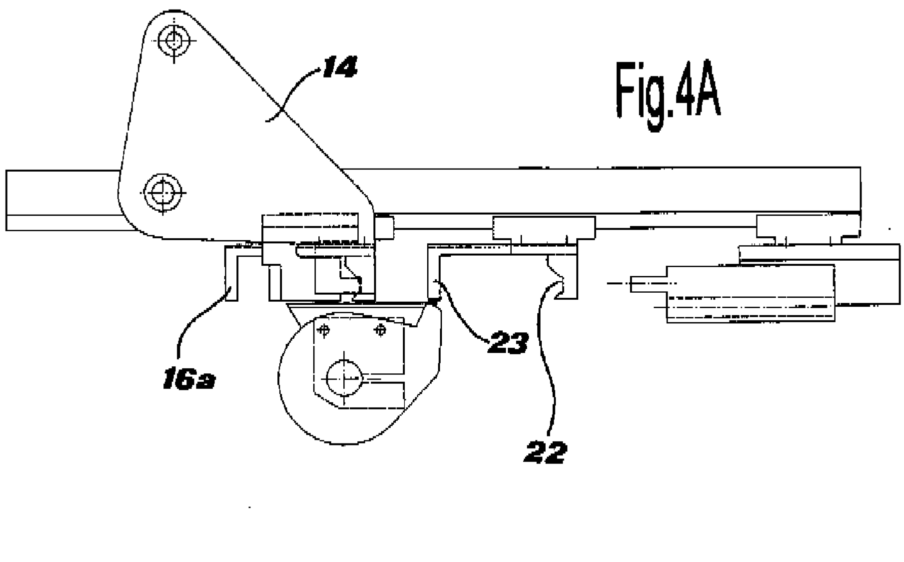


Fig.4A

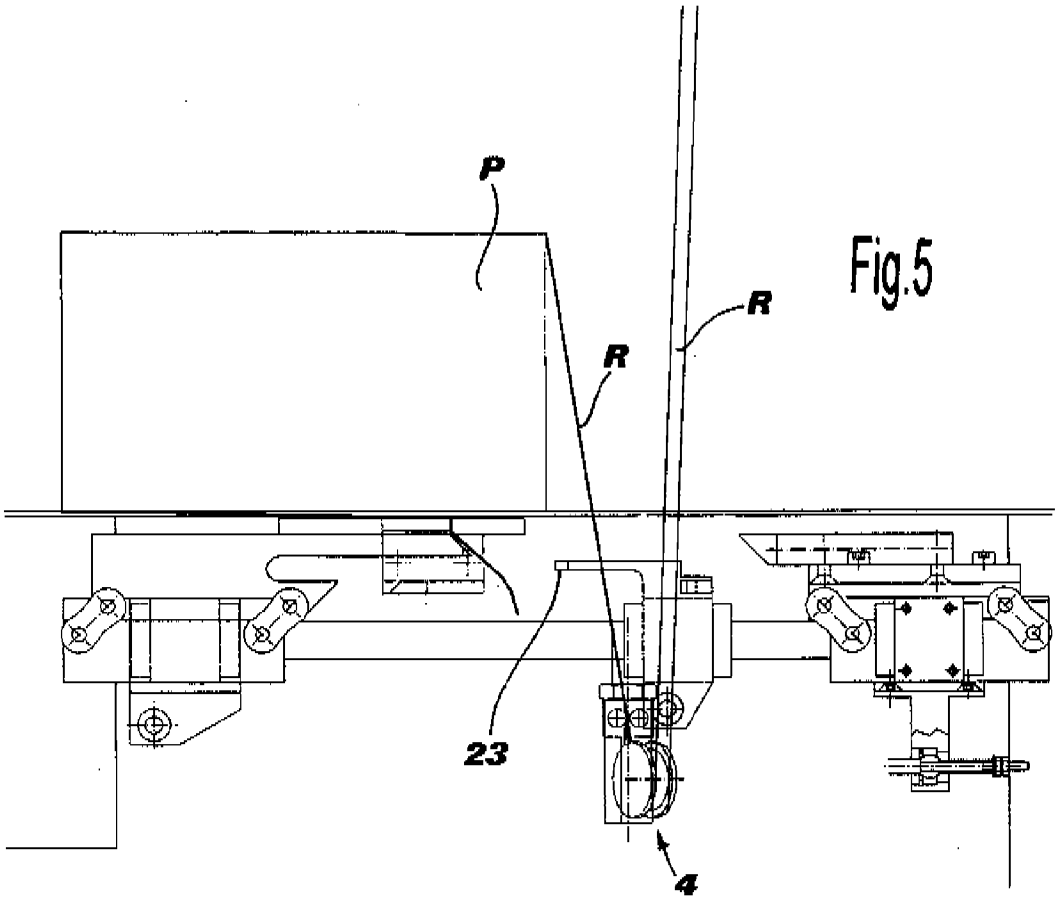


Fig.5

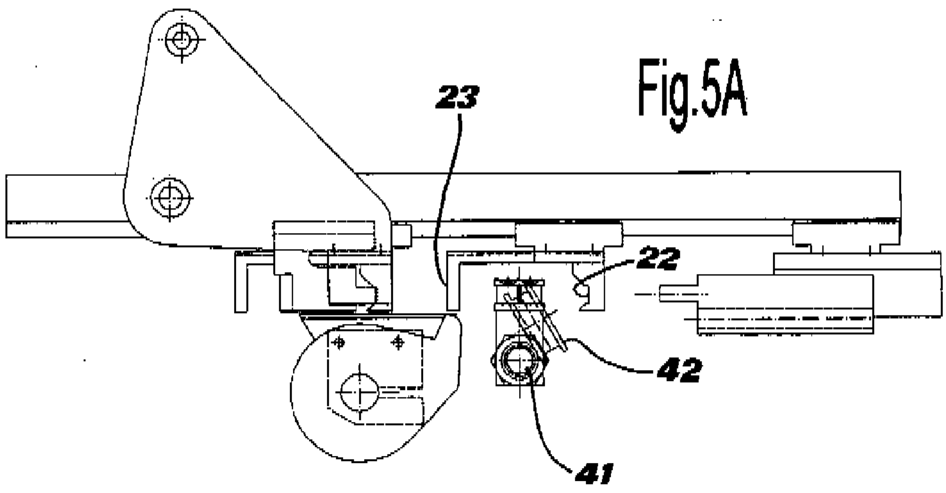


Fig.5A

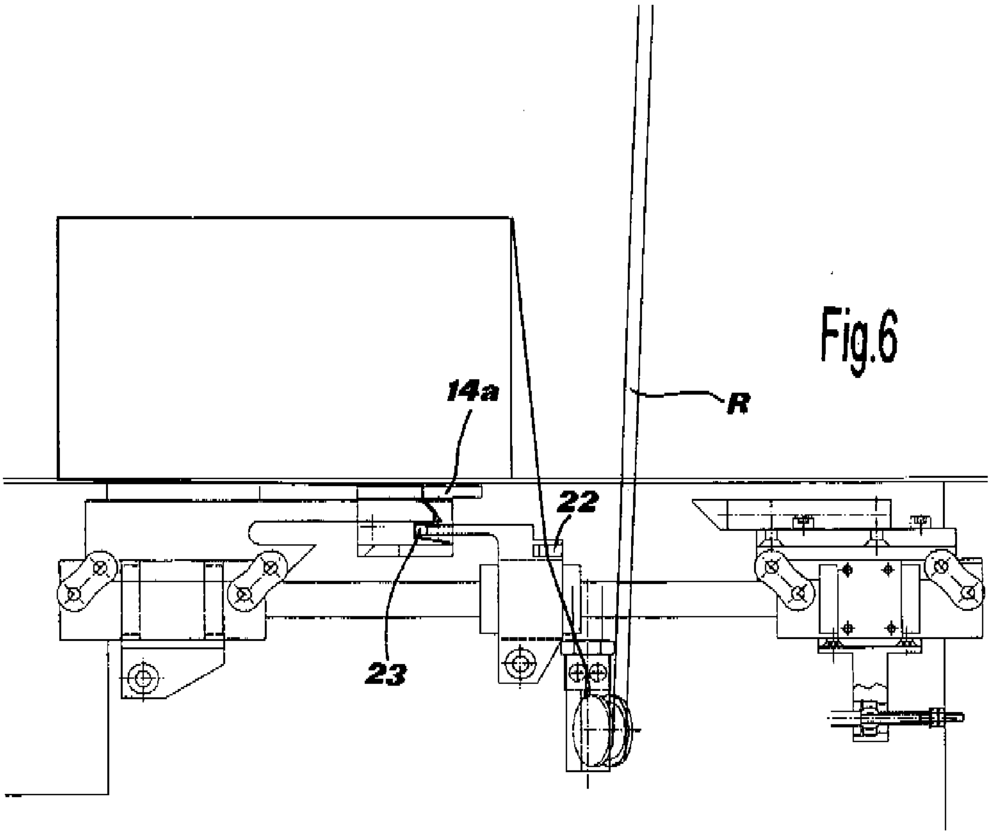


Fig.6

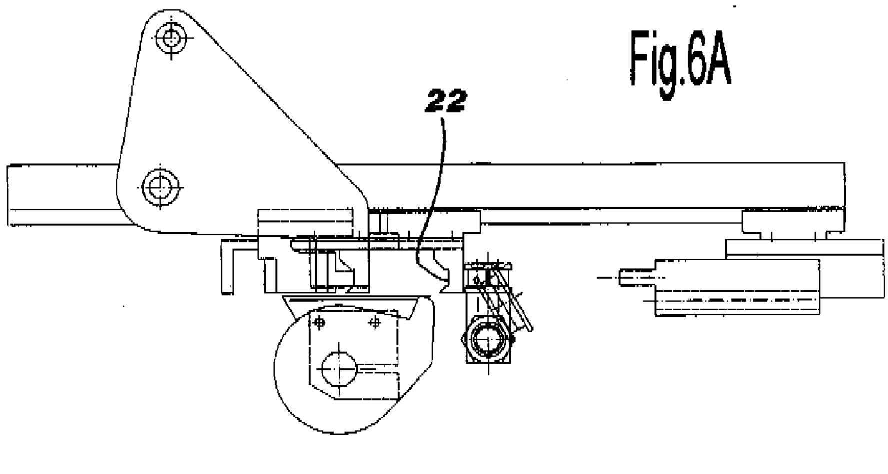


Fig.6A

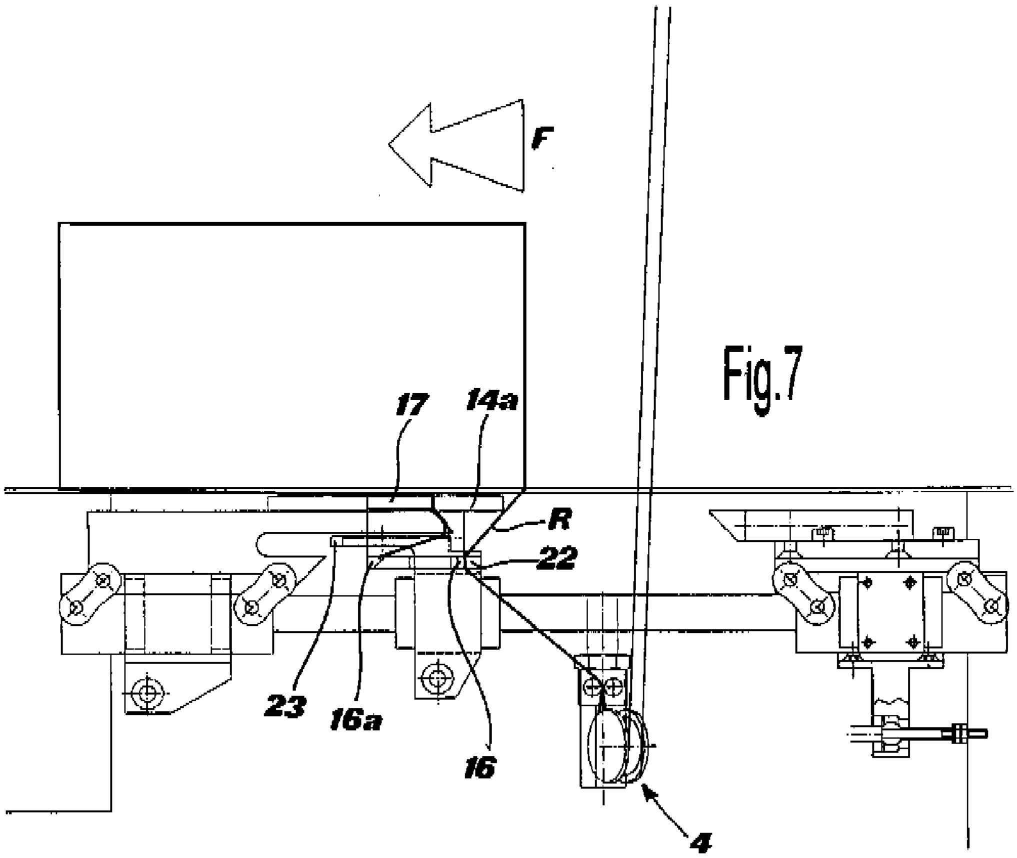


Fig.7

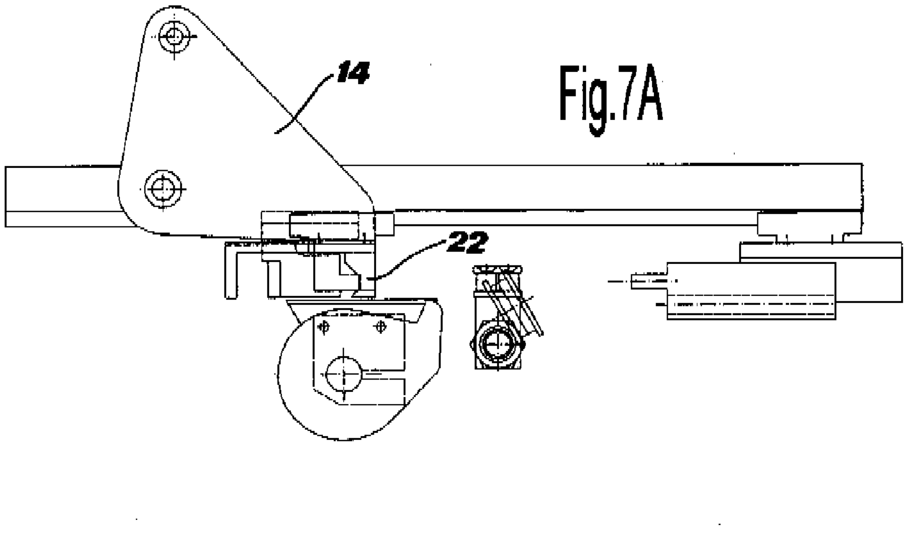


Fig.7A

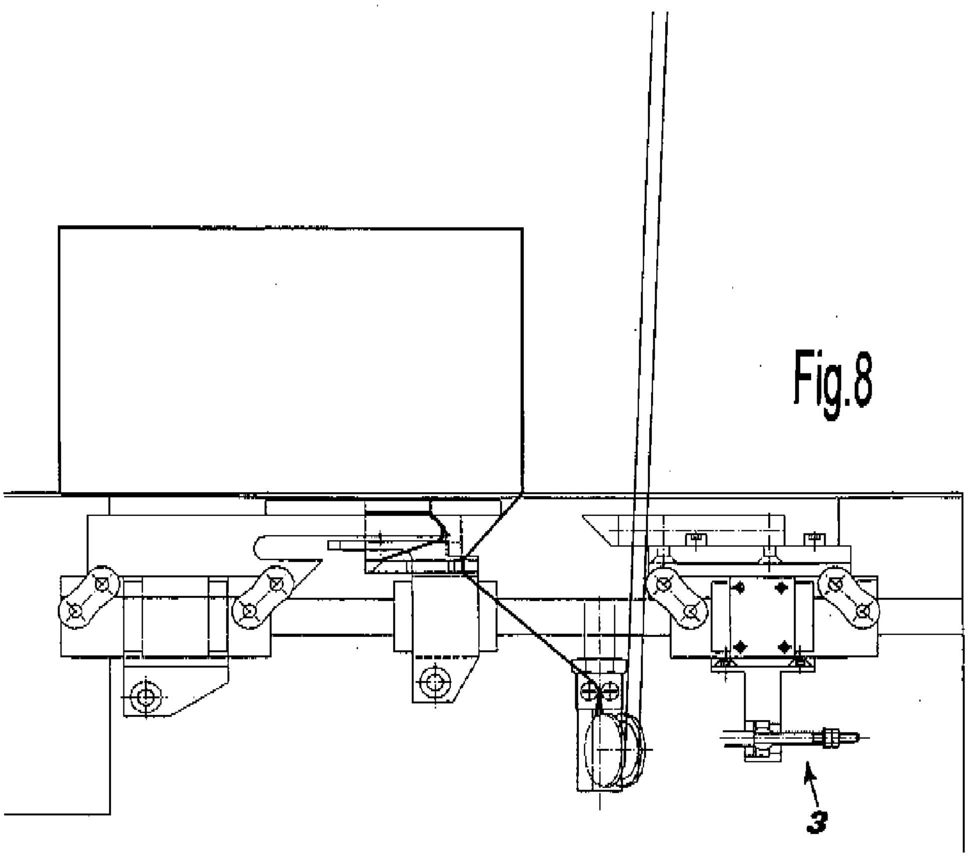


Fig.8

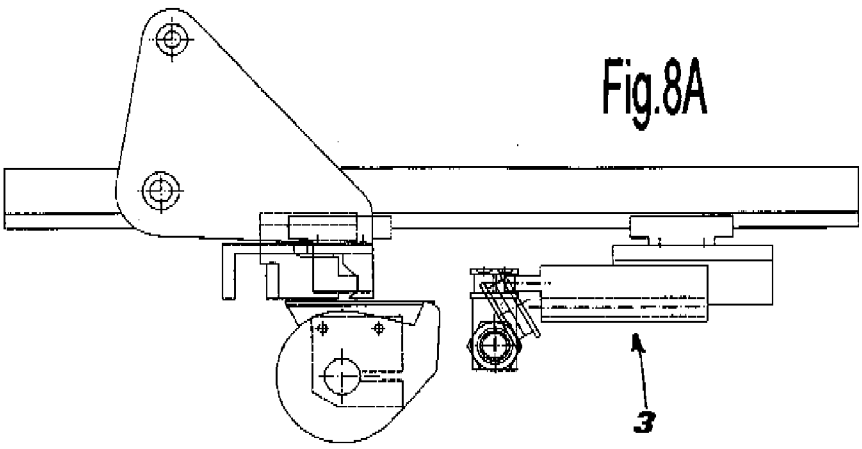


Fig.8A

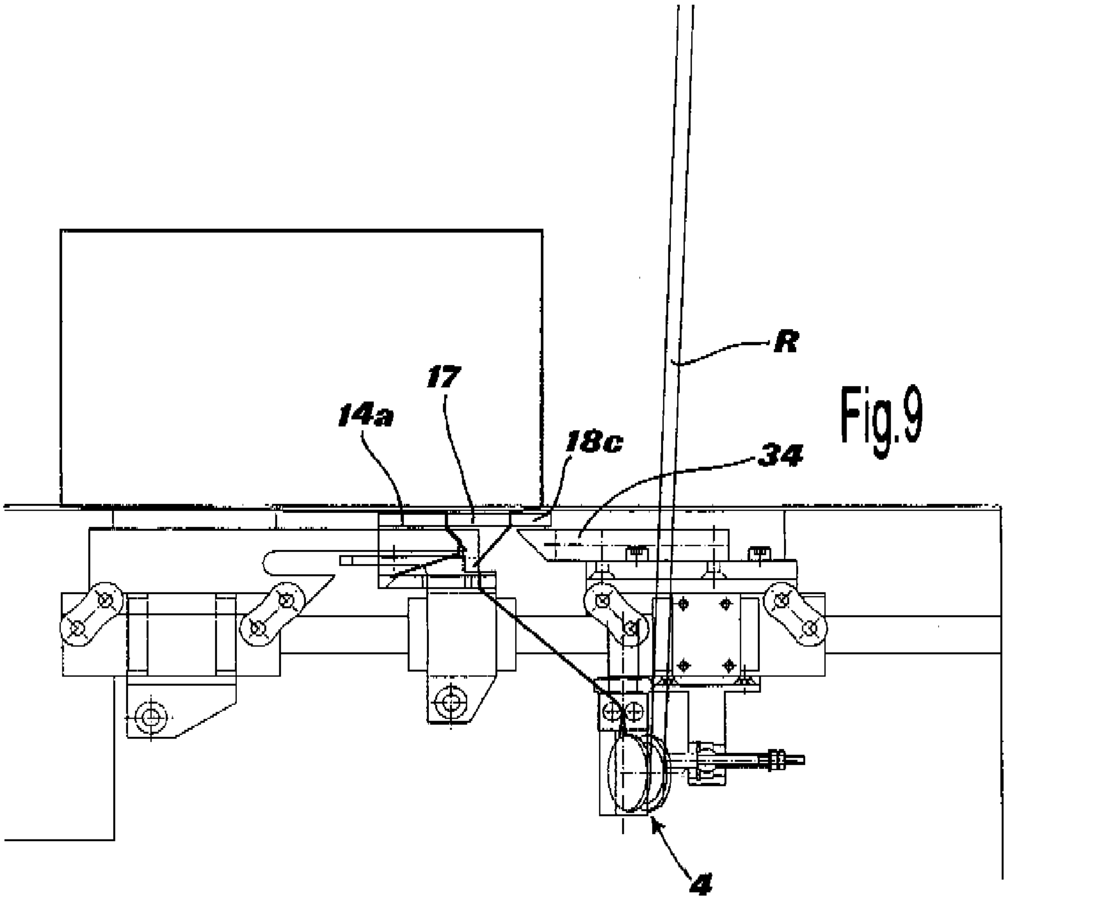


Fig.9

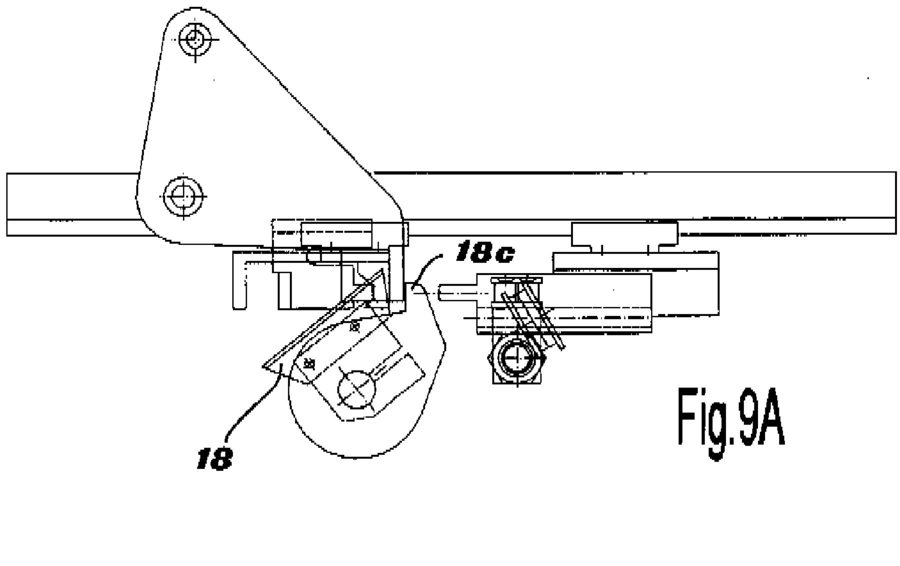


Fig.9A

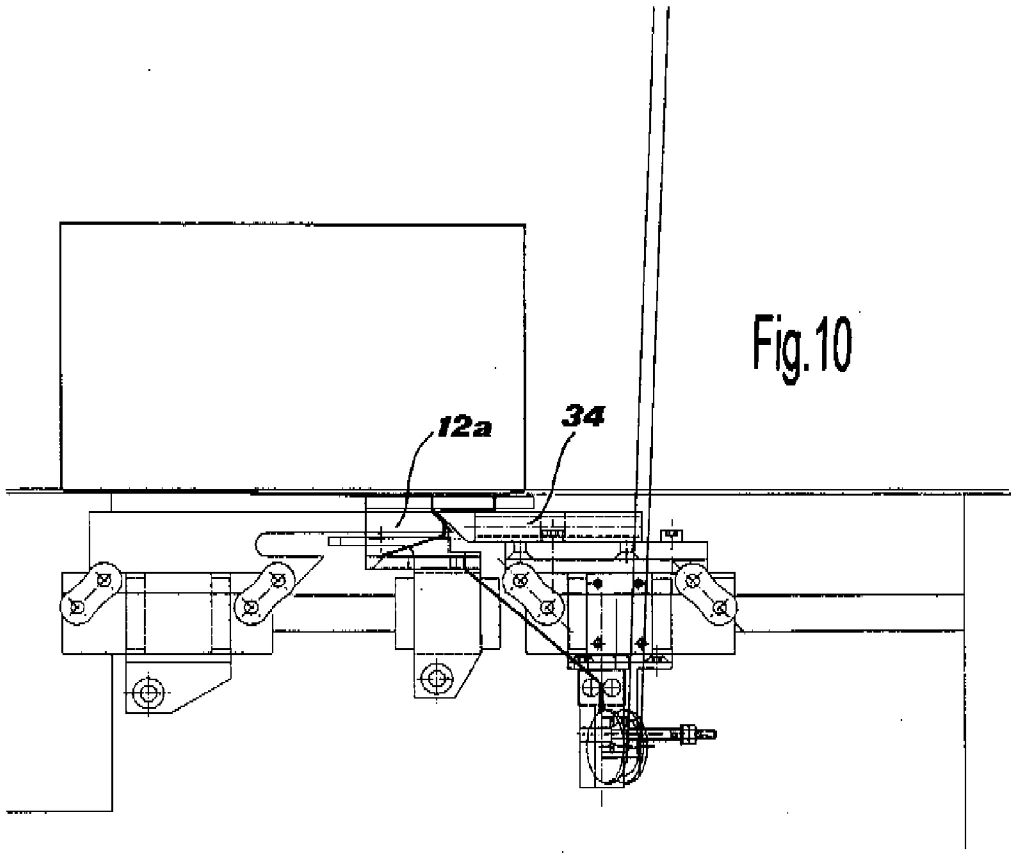


Fig.10

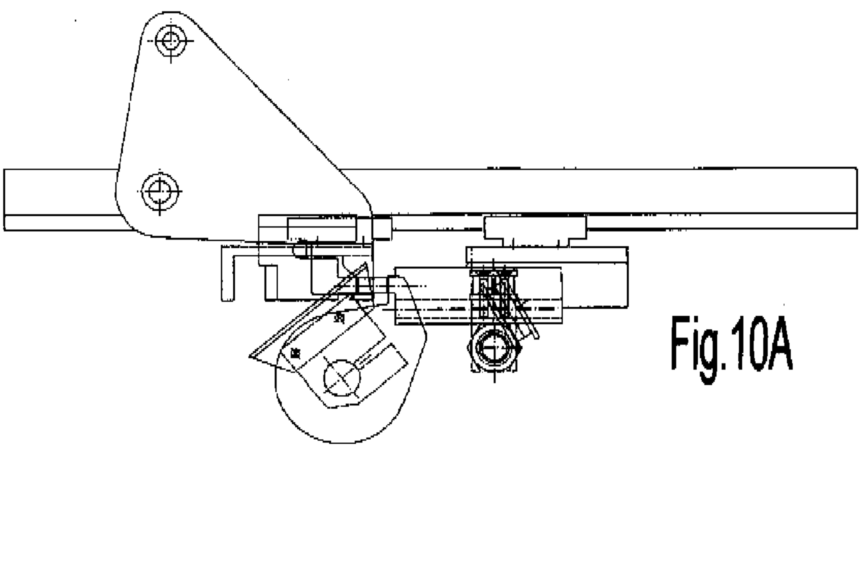


Fig.10A

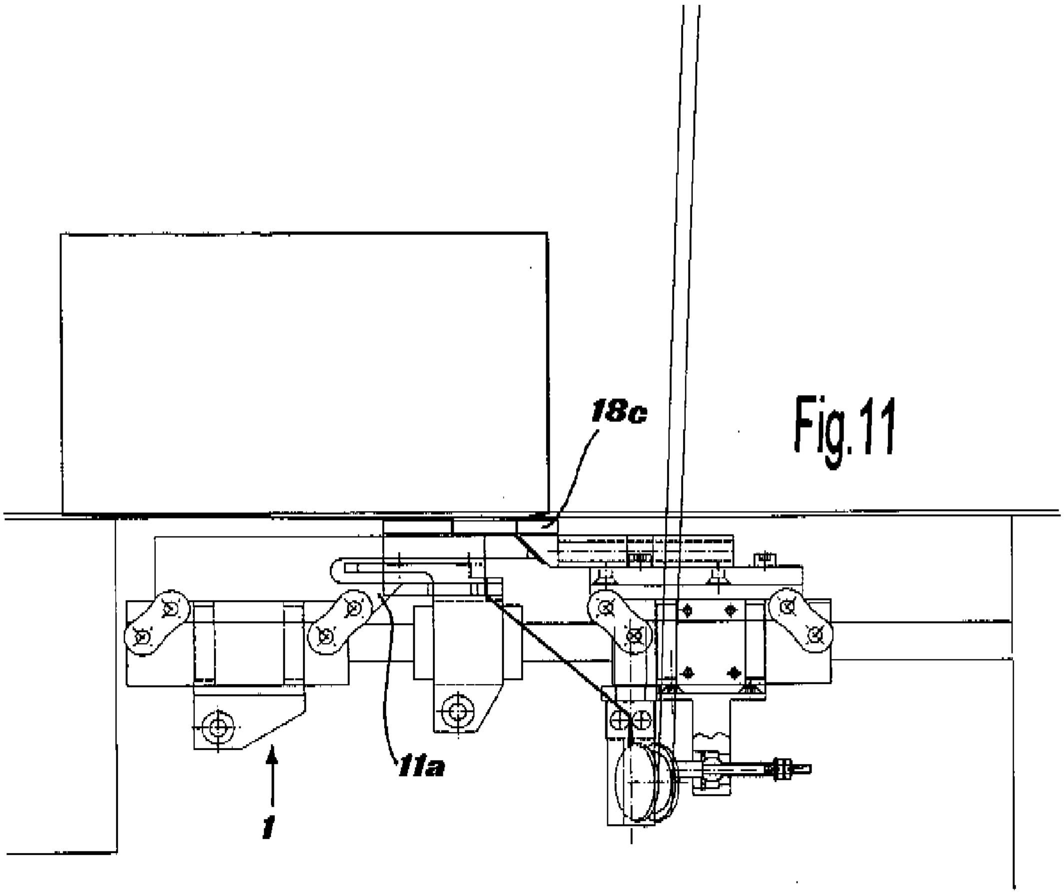


Fig.11

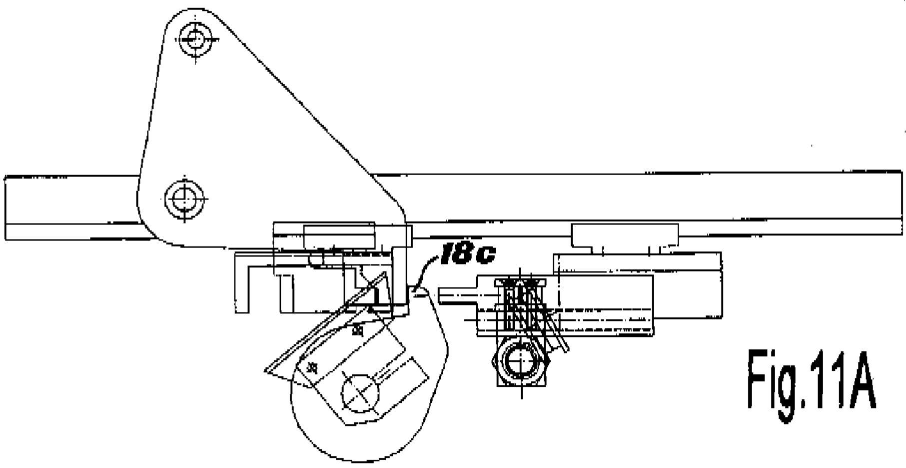


Fig.11A

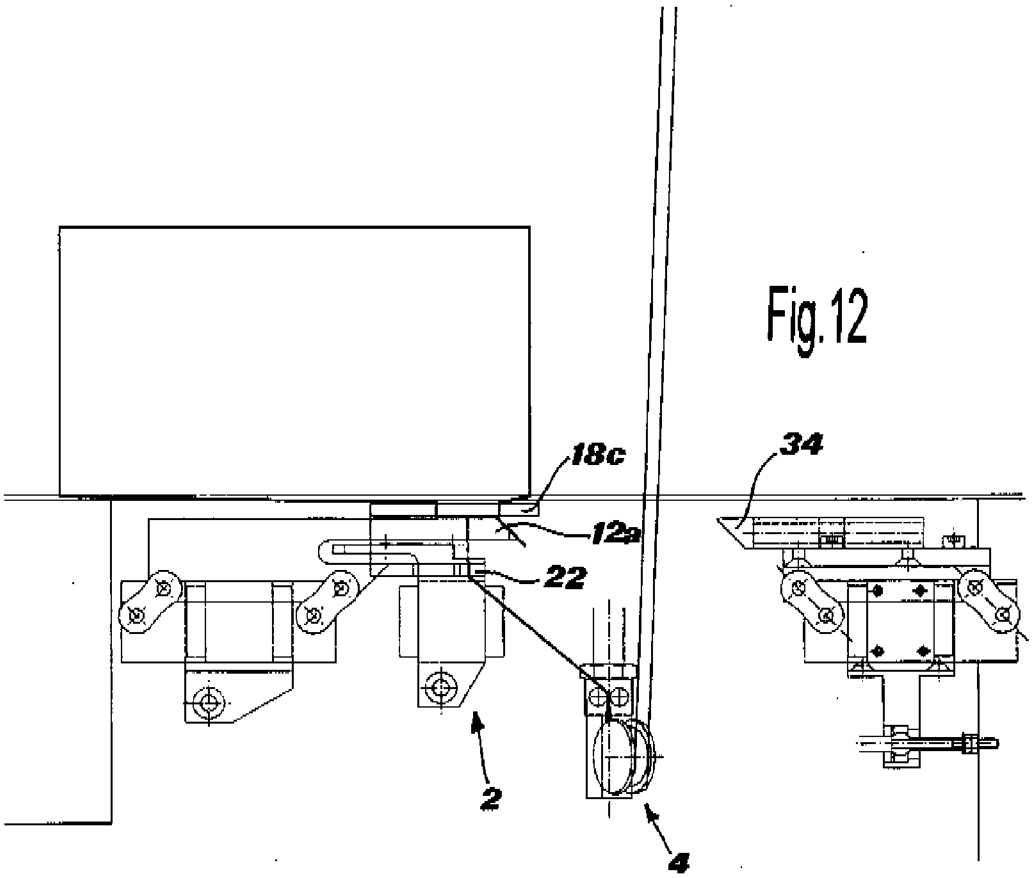


Fig. 12

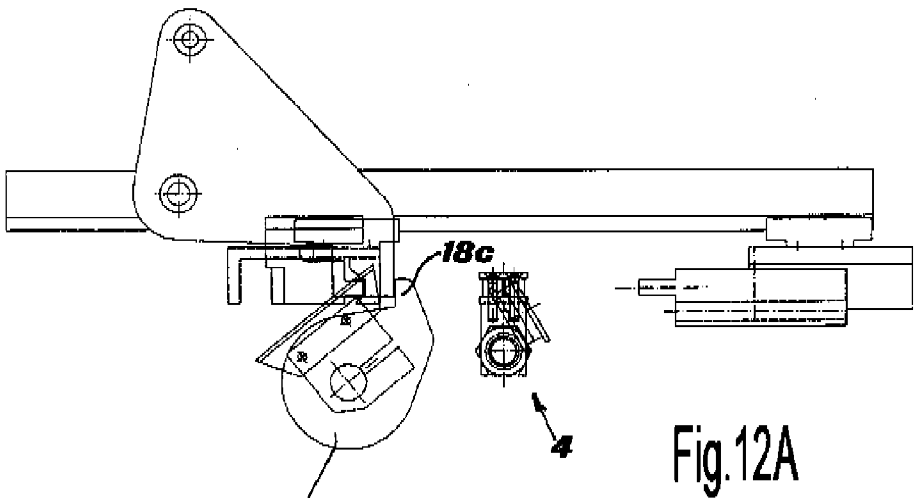


Fig. 12A

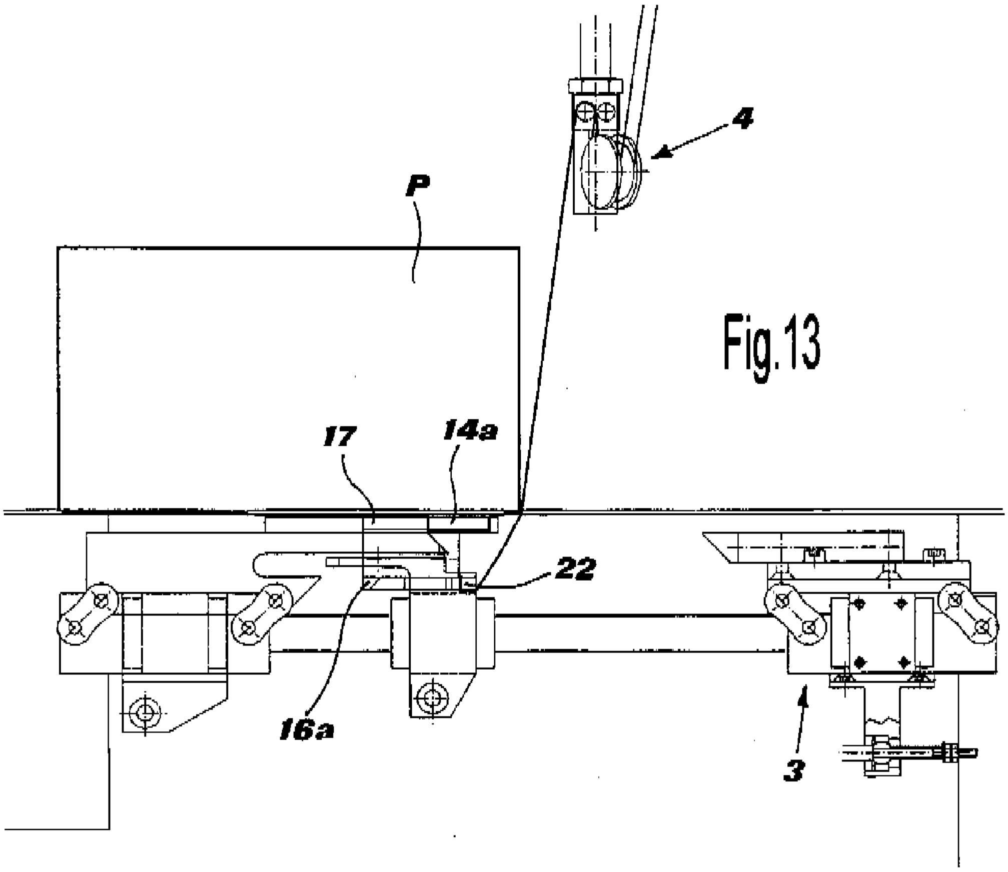


Fig.13

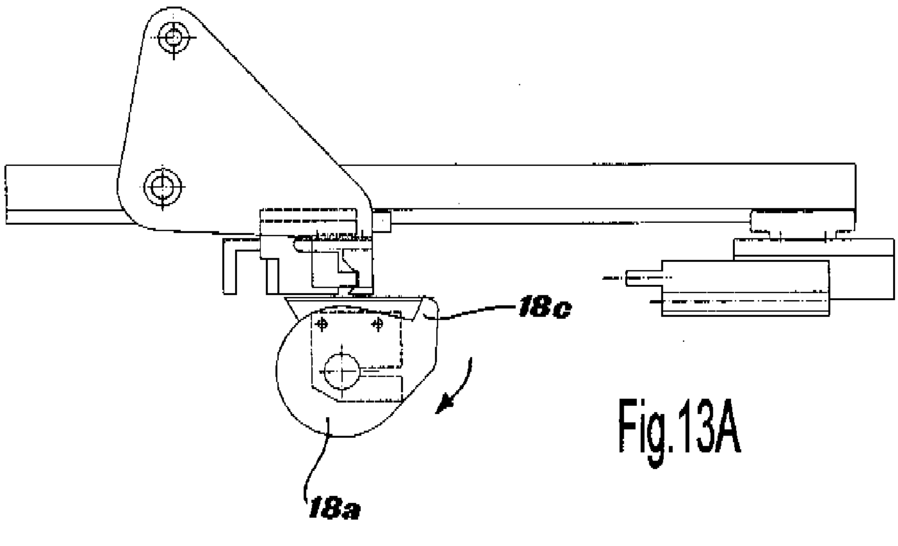


Fig.13A

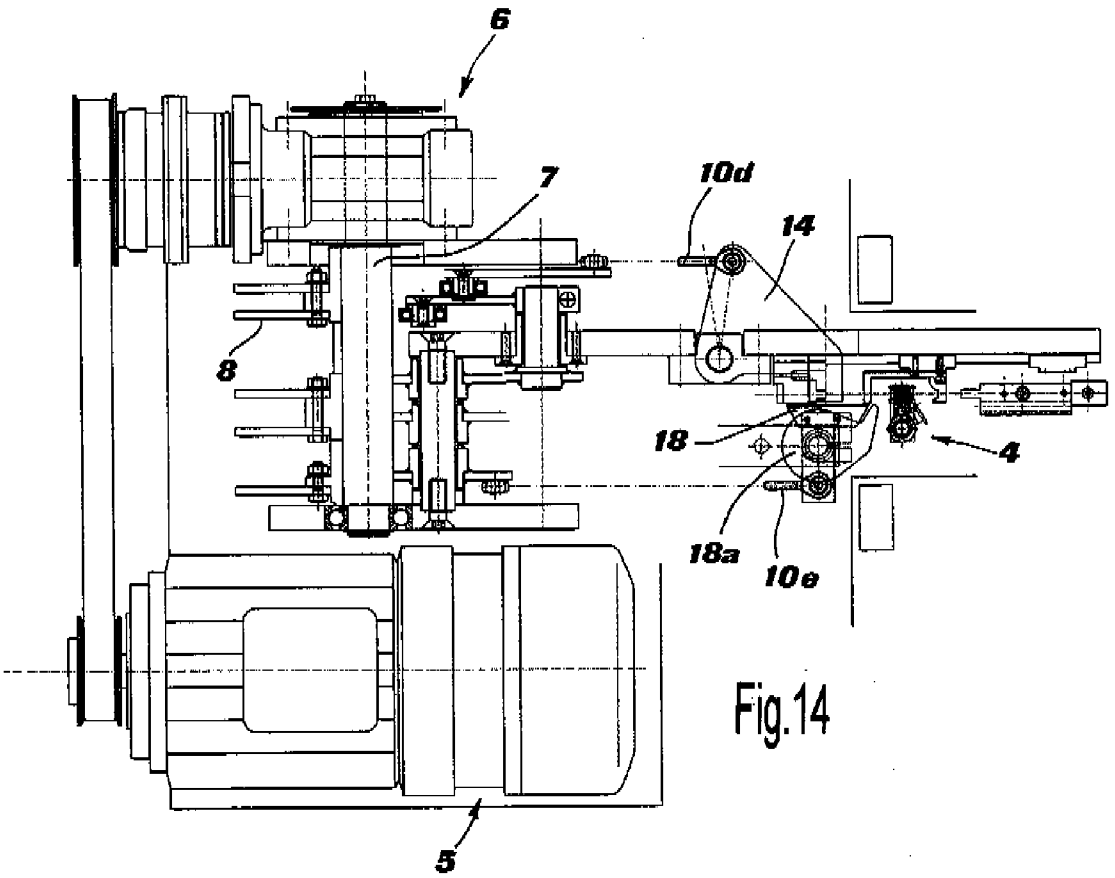


Fig.14

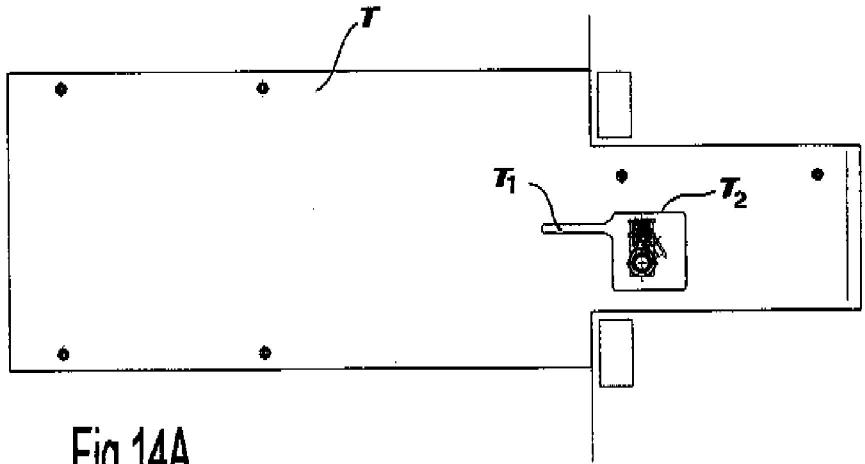


Fig.14A

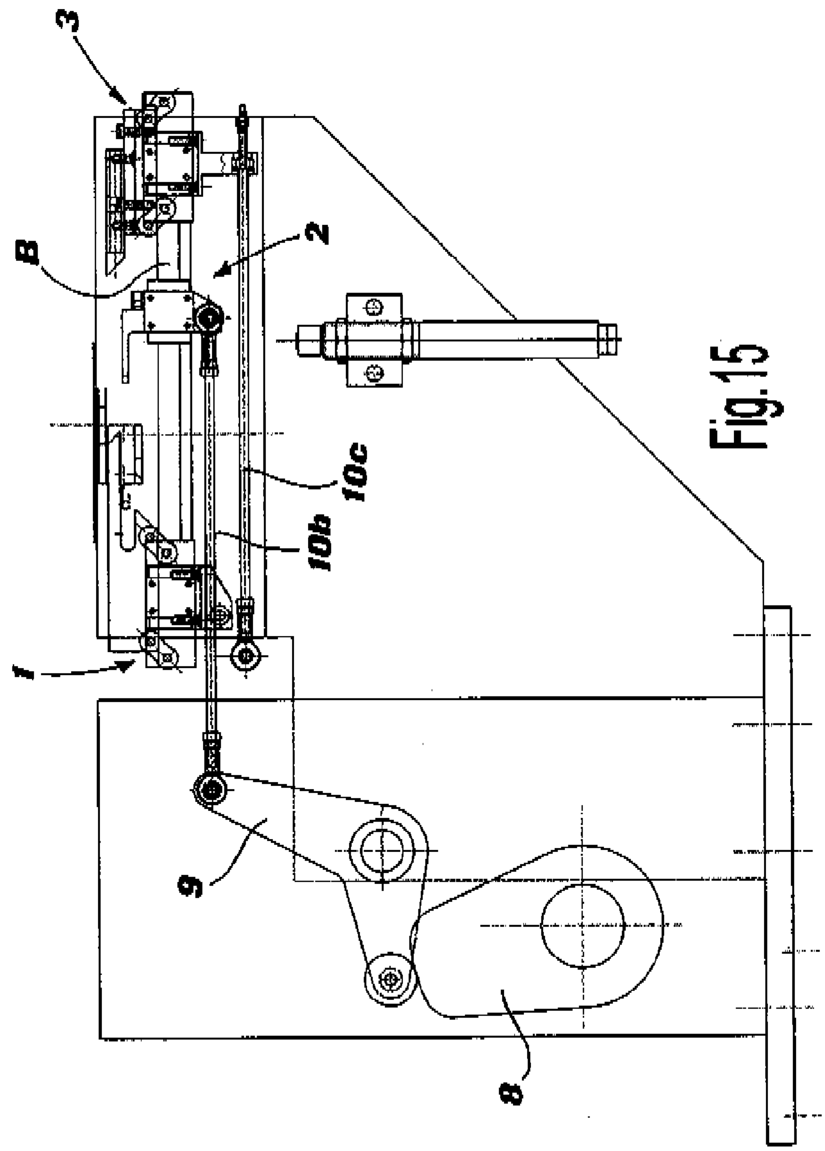


Fig.15

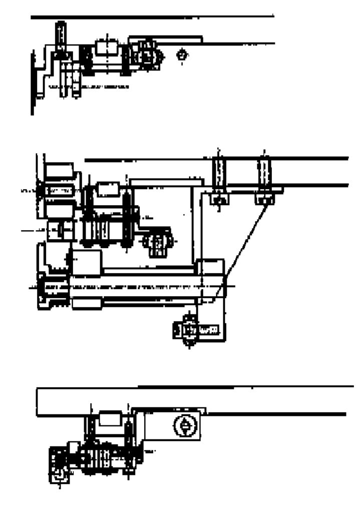


Fig.15A

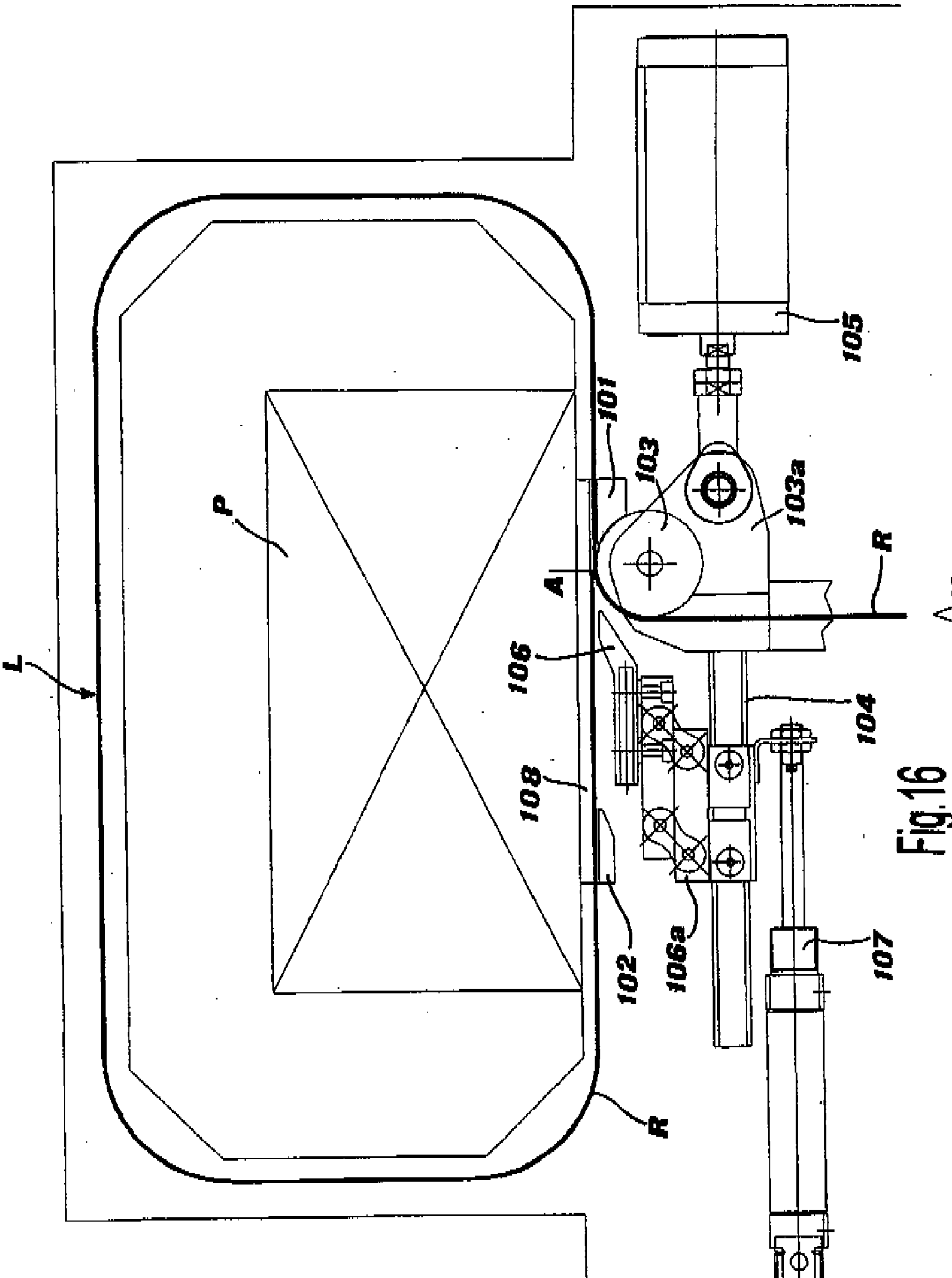


Fig.16

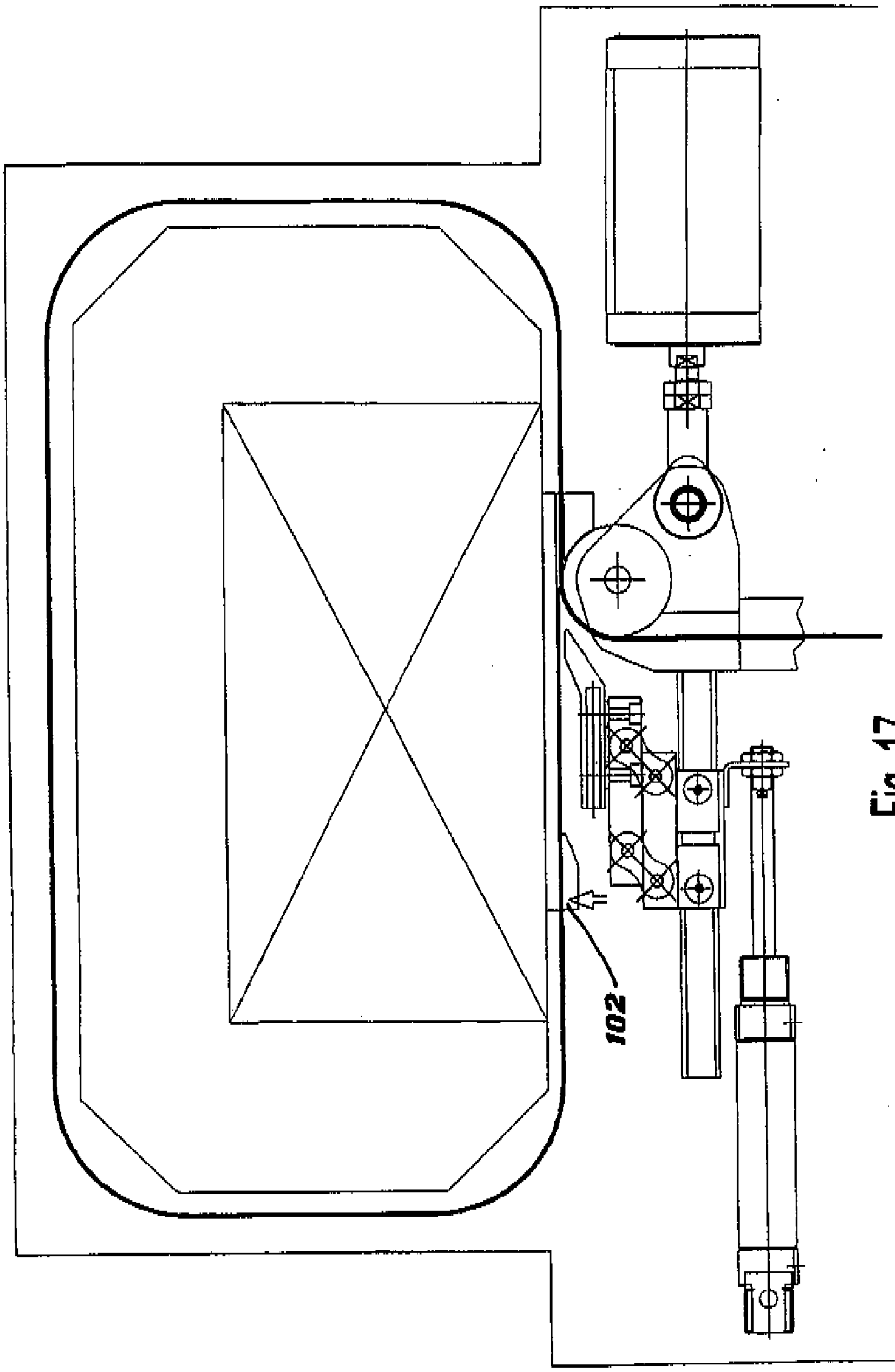


Fig. 17

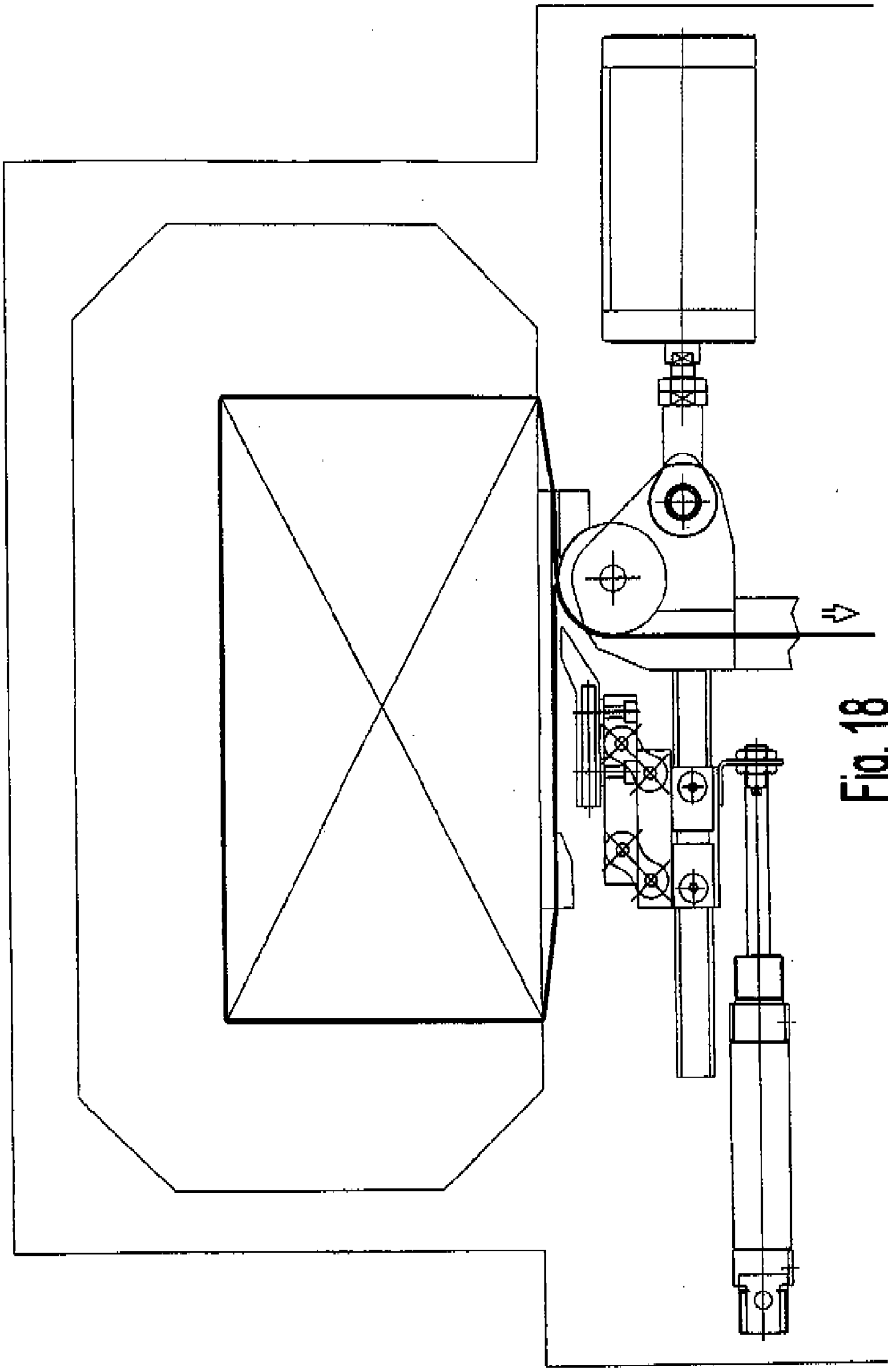


Fig. 18

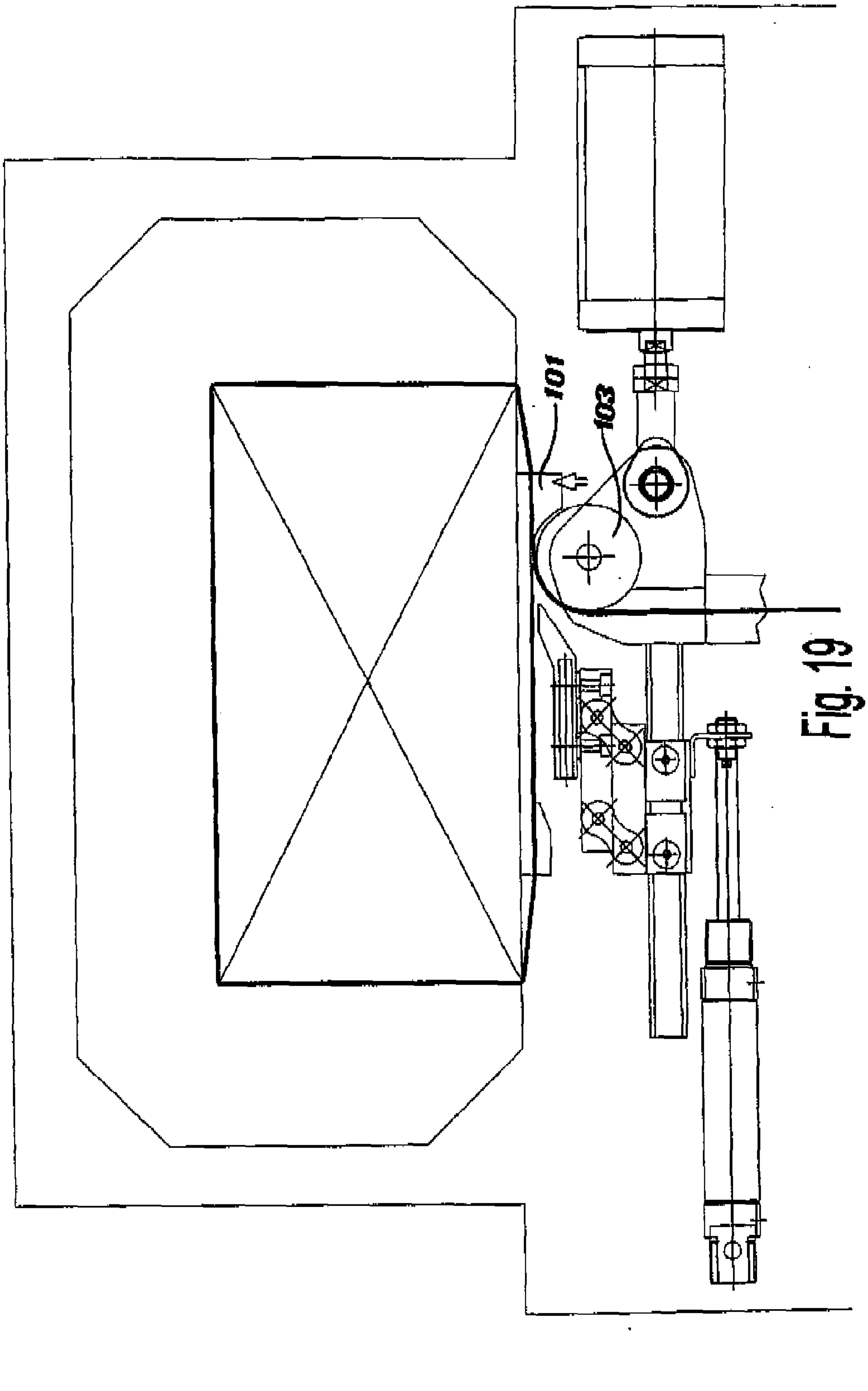


Fig. 19

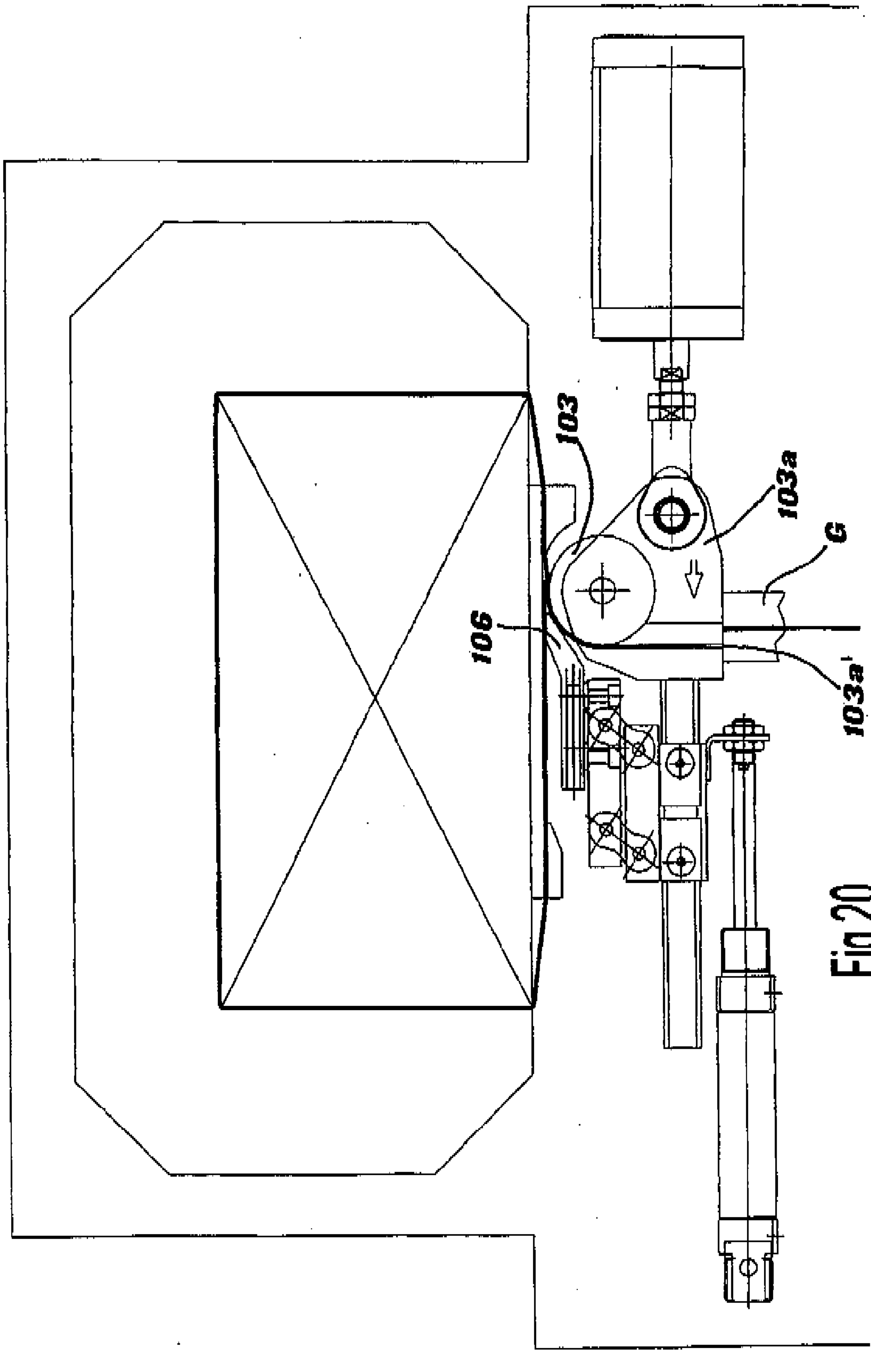


Fig.20

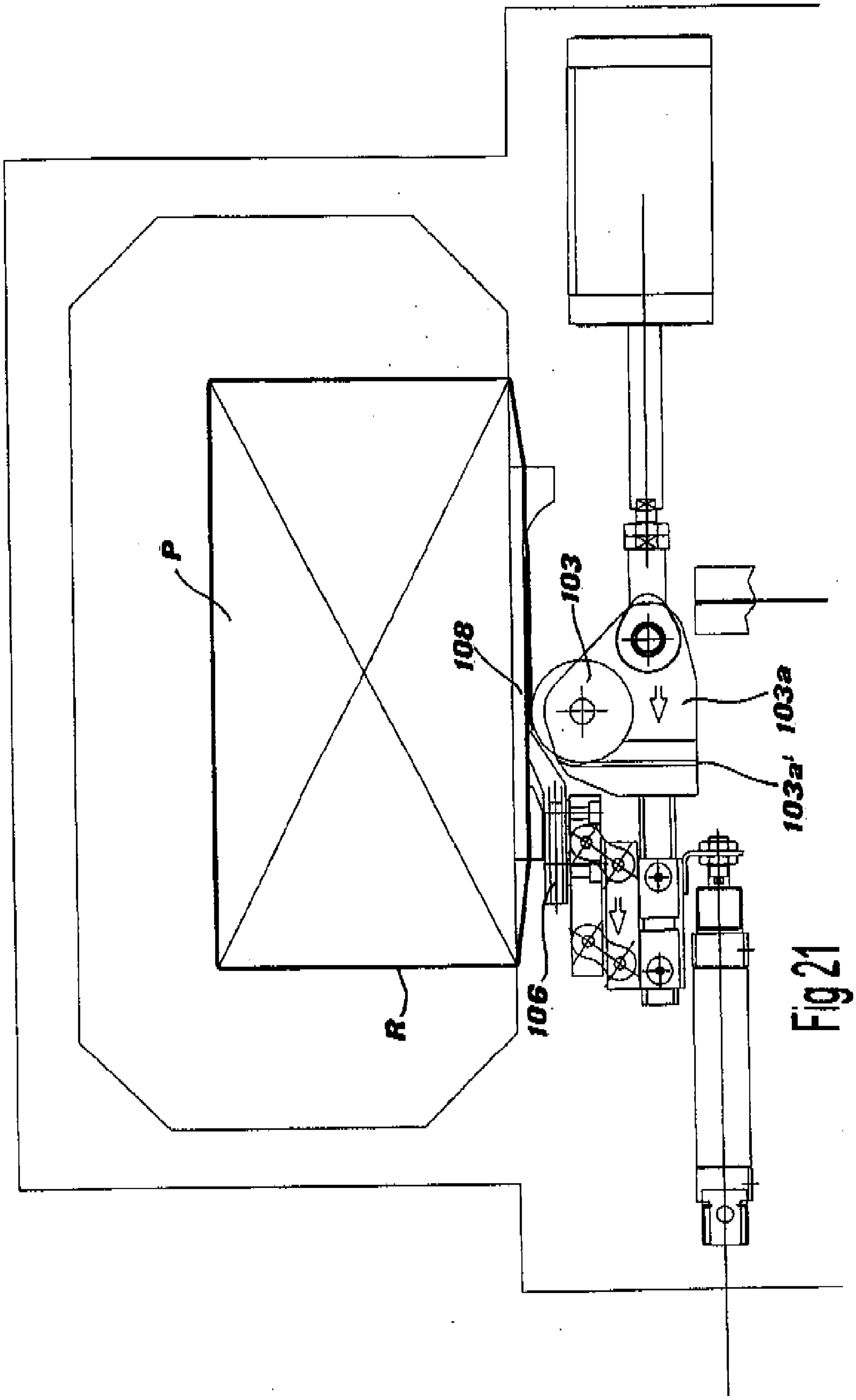


Fig 21

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- IT 1135722 B **[0002]**
- EP 0603868 A **[0002]**
- US 5379576 A **[0002]**
- US 20050028485 A1 **[0002]**
- EP 0178385 A1 **[0006]**
- EP 0401554 A1 **[0006]**
- WO 9215486 A1 **[0006]**